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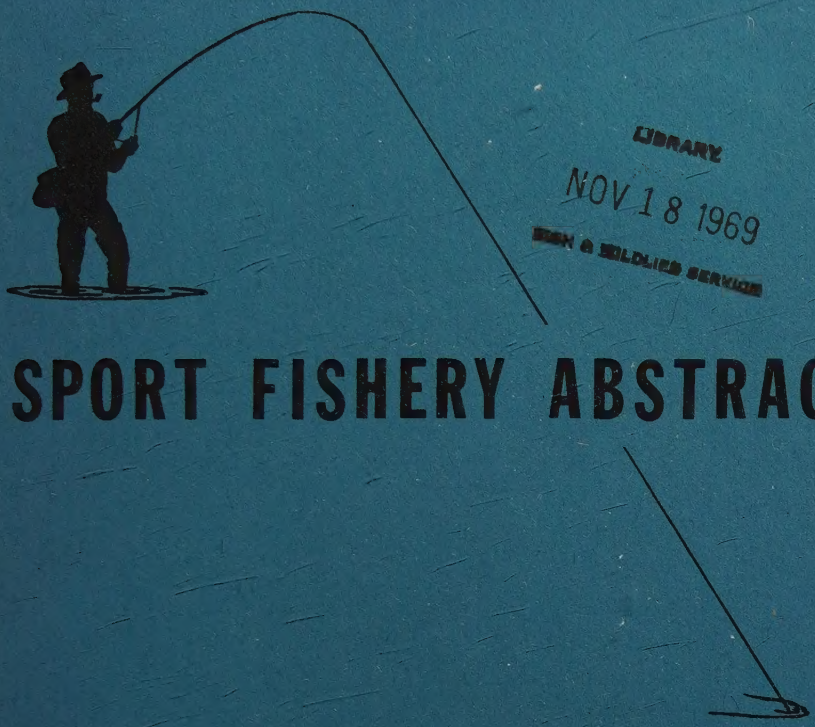

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SPORT FISHERY ABSTRACTS

Vol. 14, No. 2, 1969

Abstracts 10701 - 11000

DEPARTMENT OF THE INTERIOR

U. S. FISH AND WILDLIFE SERVICE

BUREAU OF SPORT FISHERIES AND WILDLIFE

UNITED STATES DEPARTMENT OF THE INTERIOR

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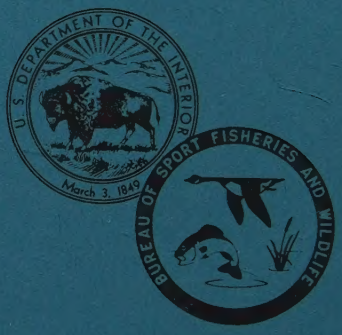

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Washington, D. C.

SPORT FISHERY ABSTRACTS

An abstracting service for fishery research and management

Vol. 14, No. 2 Abstracts, 10701-11000 1969

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10701. Vanicek, C. David, and Robert H. Kramer (Utah Coop. Fishery Unit, Utah State Univ., Logan, Utah). 1969. LIFE HISTORY OF THE COLORADO SQUAWFISH, Ptychocheilus lucius, AND THE COLORADO CHUB, Gila robusta, IN THE GREEN RIVER IN DINOSAUR NATIONAL MONUMENT, 1964-1966. Trans. Amer. Fish. Soc., 98(2): 193-208.

Investigations of the ecology and life history of the Colorado squawfish, Ptychocheilus lucius, and the Colorado chub, Gila robusta, in the Green River in Dinosaur National Monument, Colorado-Utah, were conducted from May 1964, to October 1966. A total of 1,469 squawfish and 2,393 chubs was collected with gill nets, seines, fry gear, and an electric shocker. The operation of Flaming Gorge Reservoir (46 miles above the Monument) has reduced the range of these two species in this area. Age and growth determinations were made from scales from 182 squawfish and 333 chubs. Both species grew slower in years after reservoir operation began (1963-1965) than before (1958-1962); this reduction in growth rate was related to the alteration of seasonal stream-temperature pattern caused by these operations. The bonytail form of the Colorado chub grew faster than the roundtail form. Length-frequency analyses of young squawfish and chubs described seasonal growth of the first three year-classes and provided evidence that these species reproduced successfully in Dinosaur National Monument every year since impoundment, although reproduction apparently did not occur above the mouth of the Yampa River in 1964 and 1966, years of high summer discharge from the dam and resultant lower water temperatures. Time of spawning of the two species varied and was related to water temperature and receding water level. The roundtail and bonytail forms of the Colorado chub had significantly different length-weight relationships. Squawfish over 200 mm total length were entirely piscivorous, while shorter squawfish consumed microcrustaceans and aquatic insects. The diet of the Colorado chub consisted largely of aquatic and terrestrial insects. (Authors)

10702. Hauser, William J. (U. S. Army Bldg. 5222, Dugway, Utah). 1969. LIFE HISTORY OF THE MOUNTAIN SUCKER, Catostomus platyrhynchus, IN MONTANA. Trans. Amer. Fish. Soc., 98(2): 209-215.

The life history of the mountain sucker, Catostomus platyrhynchus, was studied in southwestern Montana during 1966 and 1967. Most specimens studied were collected from two streams by seining or electrofishing. Annuli were determined on scales from 491 fish. Annuli were formed during early June. Growth history of mountain suckers was based on the calculated length at the last annulus for fish of a given age. Female mountain suckers were slightly longer than males after age five, and had greater longevity. Average lengths (mm) at the last annulus for mountain suckers of each age from the East Gallatin River with sexes combined were: I-60.5; II-98.7; III-115.3; IV-133.2; V-149.3; VI-164.6; VII-187.5; VIII-202.9; IX-220.8. Most spawning occurred during late June and early July. Males were mature at age 4 and females at age 5. Sexes were distinguished during the spawning period using secondary sexual characteristics. Number of mature eggs per female ranged from 990, for a specimen 131 mm in length, to 3,710, for one 184 mm in length. Food was mostly unidentified materials, but diatoms and other algae were important items. (Auth.)

10703. Turner, William R. (Bur. of Commercial Fisheries Biological Laboratory, Beaufort, N. C.). 1969. LIFE HISTORY OF MENHADENS IN THE EASTERN GULF OF MEXICO. Trans. Amer. Fish. Soc., 98(2): 216-224.

Biological material collected with plankton and gill nets during cruises of the R/V George M. Bowers in the eastern Gulf of Mexico indicated that menhadens spawned principally near shore from November through March. Two species of menhaden—Gulf menhaden (Brevoortia patronus) and yellowfin menhaden (B. smithi)—and their hybrid abounded in collections during the winters of 1964 through 1967. Gulf menhaden, the most important commercial species, occurred throughout the study area but its numbers decreased to the east and south. Yellowfin menhaden were confined to the coastal region of peninsular Florida, whereas hybrids were taken only from Tampa Bay south to Cape Sable. Hybrid menhaden

apparently backcross freely with the parental species but the extremely high percentage of hybrid males (≥ 99%) assures against establishment of a hybrid population. The likelihood of natural hybridization and introgression was substantiated by artificial fertilization experiments. In addition to the menhadens, six other clupeids entered the combined collections. Three of these species—Atlantic thread herring (Opisthonema oglinum), scaled sardine (Harengula pensacolae), and Atlantic round herring (Etrumeus teres)—have spawning seasons that coincide, in part, with that of the menhadens. The early life stages of these species, although undescribed, were probably represented in the plankton collections. (Auth.)

10704. Stauffer, Thomas M., and Martin J. Hansen (Michigan Dept. of Natural Resources, Marquette Fish. Res. Sta., Marquette, Mich.). 1969. MARK RETENTION, SURVIVAL, AND GROWTH OF JAW-TAGGED AND FIN-CLIPPED RAINBOW TROUT. Trans. Amer. Fish. Soc., 98(2): 225-229.

Five groups (200 each) of rainbow trout were held in a hatchery pond for 2 years and grew from 229 to 444 mm TL. Three groups were marked with different jaw tags, one was fin clipped, and one was unmarked. Condition factors of tagged, fin-clipped, and unmarked rainbow trout from Lake Michigan were also available. Tagged trout held in a hatchery retained virtually all of their tags for a year, but at the end of 2 years, the three groups had lost 5% (No. 10 ring), 15% (No. 8 ring), and 21% (No. 3 strap) of the tags. Jaw tags inhibited growth slightly but had no effect on fish condition factors. Trout bearing the No. 3 jaw tag in Lake Michigan had significantly lower condition factors than unmarked trout, but No. 10 ring-tagged trout did not. In the hatchery, 95% or more of the pelvic, pectoral, adipose, and maxillary clips were recognizable at the end of 2 years. Growth and condition of trout held in the hatchery were unaffected by a combination of clipped pectoral and pelvic fins. The clipped pectoral fin had no effect on condition of rainbow trout in Lake Michigan. (Authors)

10705. Baldes, Richard J., and Robert E. Vincent (Colorado Coop. Fish. Unit, Colorado State Univ., Ft. Collins, Colo.). 1969. PHYSICAL PARAMETERS OF MICROHABITATS OCCUPIED BY BROWN TROUT IN AN EXPERIMENTAL FLUME. Trans. Amer. Fish. Soc., 98(2): 230-238.

Physical parameters govern microhabitat characteristics. A resting microhabitat for fishes in streams becomes the focus for movement to other segments of the habitat. Brown trout were observed in a flume at flows of 0.37, 1.10, and 2.07 cm^3/sec (1.2, 3.6, and 6.8 cfs). Study fish occupied resting microhabitats within a velocity range of 12.2 to 21.3 cm/sec (0.4 to 0.7 ft/sec). Turbulence, light, water depth, spatial limits, direction of flow, and cover also influence selection. Most microhabitats were above structures or along the edge on the shaded east side of the flume. Study fish occupied areas near the bottom and were positive rheotactic. A strong thigmotactic response substituted for lack of overhead cover. Areas less than 5.1 cm (2 inches) deep and less than 20.3 cm (8 inches) square within the suitable velocity range were avoided. (Authors)

10706. Monan, Gerald E., Robert J. McConnell, John R. Pugh, and Jim R. Smith (Bur. of Commercial Fisheries Biological Lab., 2725 Montlake Blvd. East, Seattle, Wash.). 1969. DISTRIBUTION OF DEBRIS AND DOWNSTREAM-MIGRATING SALMON IN THE SNAKE RIVER ABOVE BROWNLEE RESERVOIR. Trans. Amer. Fish. Soc., 98(2): 239-244.

The distribution of chinook (Oncorhynchus tshawytscha) and coho (O. kisutch) salmon migrating downstream and the weight and vertical distribution of various types of debris were studied above Brownlee Reservoir in the Snake River during the spring and early summer of 1964. Electrified fyke nets were used in the fish sampling. Salmon and debris were present simultaneously and were distributed throughout the cross section of the river. Most of the salmon were in the upper 2.4 m of water, although appreciable numbers migrated at all depths; more migrants were in each of the two outer thirds of the river than in the middle third. Large quantities of debris, which represented a wide range of materials from algae to parts of buildings, were distributed throughout the river. To effectively collect most of the salmon migrating downstream, the entire water mass will need to be strained by some method which has the capacity to cope with large quantities of debris. (Authors)

10707. Finnell, Larry M., and Edward B. Reed (Fisheries Research Center, Colorado Game, Fish and Parks Div., Ft. Collins, Colo.). 1969. THE DIEL VERTICAL MOVEMENTS OF KOKANEE SALMON, Oncorhynchus nerka, IN GRANBY RESERVOIR, COLORADO. Trans. Amer. Fish. Soc., 98(2): 245-252.

Sonar equipment was used at Granby Reservoir, Colorado, 1963 to 1966, to correlate environmental factors with diel vertical movements of kokanee salmon introduced into the reservoir in 1952. Twenty-four hour operation of this equipment revealed that salmon schools were located throughout the upper 9 meters of water during the day, followed by migration and concentration at depths from 9 to 18 meters at night, where temperatures averaged 10-13° C. Light intensity at the lower water strata appeared to be correlated with upward movements of the schools at dawn. Zooplankton, utilized by kokanee salmon as food, was present in major concentrations above the 9 meter depth. No evidence of vertical migration by zooplankters over the diel period was established. Analysis of 359 kokanee stomachs obtained by vertically set gill nets revealed Daphnia pulex as the organism most frequently ingested. Tentative conclusions based on observations made during summer months indicate that kokanee feed diurnally on zooplankton at shallow depth and begin descent to areas within and below the metalimnion in early evening, presumably to rest and assimilate food. At dawn, possibly triggered by penetration of light to the lower strata, the fish begin upward migrations and resumption of feeding activities. (Authors)

10708. Elwood, Jerry W., and Thomas F. Waters (Dept. of Entomology, Fisheries, and Wildlife, Univ. of Minnesota, St. Paul, Minn.). 1969. EFFECTS OF FLOODS ON FOOD CONSUMPTION AND PRODUCTION RATES OF A STREAM BROOK TROUT POPULATION. Trans. Amer. Fish. Soc., 98(2): 253-262.

Food consumption and production rates were estimated for a stream population of brook trout, Salvelinus fontinalis Mitchill, over a two-year period (1965-1966) in which four severe floods occurred. Two year classes were nearly eliminated as producing components of the population. Standing crops of older age groups were reduced as a result of a decrease in the stream's carrying capacity after sand and debris carried into the stream by flood waters filled pools and blanketed riffle areas. Invertebrate populations were also severely damaged by floods, reducing the food supply and causing an apparent decrease in growth rates in 1965 when three of the four floods occurred. Results of laboratory feeding experiments at four different temperature-season combinations were used to estimate food consumption rates of the brook trout in their natural environment. Maintenance requirement increased with increasing temperature in the spring and summer and decreased with decreasing temperature in the fall and winter. Net efficiency of food utilization increased with increasing temperature in the spring and summer and decreased in the fall and winter. The smaller fish, <63 g, had a greater percentage maintenance at all temperature-season combinations except in the fall when they had a lower percentage maintenance requirement than the larger fish, 63 g and $>$. Annual production rates in 1965 and 1966 were 61.4 and 43.5 kg/ha, respectively. Annual food consumption rates in the same two years were 855.6 and 370.1 kg/ha. The two year classes entering the population during the study contributed only 7% to the total accumulated production during the two-year study period. (Authors)

10709. Fraser, J.M., and F.W.H. Beamish (Research Branch, Dept. of Lands and Forests, Maple, Ontario, Canada). 1969. BLOOD LACTIC ACID CONCENTRATIONS IN BROOK TROUT, Salvelinus fontinalis, PLANTED BY AIR DROP. Trans. Amer. Fish. Soc., 98(2): 263-267.

The level of lactic acid in the blood of brook trout increased significantly after planting by air drop but remained well below levels associated with fatigue deaths in other species. Blood lactic acid level was the highest among trout which had been loaded more heavily for transport. (Authors).

10710. Bullock, G. L., and S. F. Snieszko (Bur. of Sport Fisheries and Wildlife, Eastern Fish Disease Lab., Kearneysville, W. Va.). 1969. BACTERIA IN BLOOD AND KIDNEY OF APPARENTLY HEALTHY HATCHERY TROUT. Trans. Amer. Fish. Soc., 98(2): 268-271.

Aseptic examination of blood and kidney material from three species of apparently healthy trout at two hatcheries showed that 12.5% of examined trout at one hatchery and 26.1% of trout at the other carried low numbers of bacteria. In addition, sera from these trout had agglutinins against some of the isolated bacteria and bacterial types found in trout were the same as those cultured from raceway water in which fish were raced. Although the presence of these bacteria does not constitute a disease state, the potential for an epizootic is present should trout be placed under stress conditions. (Authors)

10711. Brungs, William A. (Natl. Water Quality Lab., Newtown Fish Toxicology Lab., Fed. Water Pollution Control Admin., Cincinnati, Ohio). 1969. CHRONIC TOXICITY OF ZINC TO THE FATHEAD MINNOW, Pimephales promelas Rafinesque. Trans. Amer. Fish. Soc., 98(2): 272-279.

A continuous-flow bioassay was conducted for 10 months to determine the chronic effect of zinc on fathead minnows (Pimephales promelas Rafinesque). Fish production, as based on survival, growth, and reproduction, was investigated. Reproduction by the test fish was almost totally inhibited at zinc concentrations that had no effect on survival, growth, or maturation of these same fish. At these same concentrations there was also no effect on survival of control eggs and fry. The number of eggs produced per female in the low zinc concentration (0.18 mg/l) was only 17% of the eggs produced in the control (0.03 mg/l of zinc). Application factors based on these data and the 96-hour median tolerance limit (9.2 mg/l) are discussed. (Auth.)

10712. Stock, Jay N., and Oliver B. Cope (Fish-Pesticide Research Laboratory, Bur. of Sport Fisheries and Wildlife, Columbia, Mo.). 1969. SOME EFFECTS OF TEPA, AN INSECT CHEMOSTERILANT, ON THE GUPPY, Poecilia reticulata. Trans. Amer. Fish. Soc., 98(2): 280-287.

Guppies, Poecilia reticulata Peters, were bathed in sublethal levels of TEPA, tris(1-aziridinyl) phosphine oxide, to determine its effect on reproduction and on the viability, survival, and reproduction of the unexposed F_1 generation. Male fertility was adversely affected at levels which did not influence female reproduction. Histological changes induced by TEPA were observed only in testicular tissue. Inhibited brood production was associated with both atrophied and morphologically "normal" testes; the effects varied with the concentration and frequency of exposure to TEPA. When exposures were discontinued, potency of males appeared to recover. No apparent effects were observed on the F_1 generation. (Authors)

10713. Finucane, John H. (Bur. of Commercial Fisheries Biological Laboratory, St. Petersburg Beach, Fla.). 1969. ANTIMYCIN AS A TOXICANT IN A MARINE HABITAT. Trans. Amer. Fish. Soc., 98(2): 288-292.

A marine impoundment in Tampa Bay, Florida, was treated with Antimycin A at a concentration of 7 ppb. Effects of the toxicant were observed for finfish and invertebrates of the area. Degree of fish sensitivity varied among families and species. Representatives of 38 species of fish were killed within 3 days after application of the poison, although several species of fish proved resistant to antimycin in the concentration used. Zooplankton and invertebrates were unaffected; however, lancelets were highly susceptible. Antimycin was completely degraded in about 5 days. (Auth.)

10714. Park, Donn L. (Bur. of Commercial Fisheries Biological Lab., Seattle, Wash.). 1969. SEASONAL CHANGES IN DOWNSTREAM MIGRATION OF AGE-GROUP 0 CHINOOK SALMON IN THE UPPER COLUMBIA RIVER. Trans. Amer. Fish. Soc., 98(2): 315-317.

10715. Heman, M. LeRoy, Robert S. Campbell, and Lee C. Redmond. 1969. MANIPULATION OF FISH POPULATIONS THROUGH RESERVOIR DRAWDOWN. Trans. Amer. Fish. Soc., 98(2): 293-304.

A summer drawdown was implemented on Little Dixie Lake, an 83 ha (205-acre) Central Missouri impoundment, to improve growth rate of largemouth bass (Micropterus salmoides) and to re-establish populations of desirable size. Water level was lowered 2.4 m (8 ft) between July 19-29, 1964. Surface area was reduced by 42% and the volume by approximately 58%. As a result of draining water from the bottom of this lake the hypolimnial waters were removed. Temperature gradient in the remaining epilimnial waters was broken and the lake became homothermos at 30° C (86° F). Stomach analysis of largemouth bass indicated an increase in feeding activity following drawdown. Grams of food found in the stomach per 0.454 kg (1 lb) of bass was used as an index to feeding. These values increased from 4.0 g of food per 0.454 kg (1 lb) of fish prior to drawdown to 10.7 following drawdown. Percent of empty stomachs also decreased during the post-drawdown period. Scales collected from largemouth bass indicated an acceleration of growth in the year of drawdown, 1964. The increase in this increment of growth for 1964 over the previous year for age groups I, II, and III was 4.0, 4.0, and 3.3 cm (1.6, 1.6, 1.3 inches) respectively. Harvest of bluegill increased immediately following the drawdown and declined during the succeeding two-month period. Largemouth bass harvest was reduced during August but there were increases in the numbers and average size of fish caught through September and October. Shoreline seining before and after the drawdown indicated the density of fry and intermediate bluegill (Lepomis macrochirus) was reduced. It was thought the drawdown was responsible for a portion of this reduction through stranding of small sunfish in weed beds and shallow pools, through increased predation by bass on these small sunfish, and through exposure of nests as the water was lowered. (Authors)

10716. Gunning, Gerald E., and Tim M. Berra (Dept. of Biology, Tulane Univ., New Orleans, La.). 1969. FISH REPOPULATION OF EXPERIMENTALLY DECIMATED SEGMENTS IN THE HEADWATERS OF TWO STREAMS. Trans. Amer. Fish. Soc., 98(2): 305-308.

Fish repopulation of experimentally decimated segments in the headwaters of two Louisiana streams was studied over a period of two years. Fishes were decimated using an electrical shocking device. The sharpfin chubsucker, Erimyzon tenuis, was able to repopulate the decimated segment of Talisheek Creek in excess of the total weight of suckers that were collected when the section of stream was originally decimated. The repopulation sample exceeded the decimation sample on a total weight basis for two successive years at Talisheek Creek. Repopulation did not occur to this extent at Bayou Lacombe where the repopulation sample was 52% of the decimation sample on a total weight basis. Decimation was accomplished without disturbing the environment to any significant degree, hence fish were returning to the decimated area under the same conditions, for all practical purposes, that prevailed at the time of decimation. (Authors)

10717. Anderson, Richard O., and M. LeRoy Heman (Missouri Coop. Fish. Unit, Univ. of Missouri, Columbia, Mo.). 1969. ANGLING AS A FACTOR INFLUENCING CATCHABILITY OF LARGEMOUTH BASS. Trans. Amer. Fish. Soc., 98(2): 317-320.

10718. Kilambi, Raj V., and Raymond E. Baglin, Jr. (Dept. of Zoology, Univ. of Arkansas, Fayetteville, Ark.). 1969. FECUNDITY OF THE THREADFIN SHAD, Dorosoma petenense, IN BEAVER AND BULL SHOALS RESERVOIRS. Trans. Amer. Fish. Soc., 98(2): 320-322.

10719. Sheri, A. N., and G. Power (Dept. of Biology, Univ. of Waterloo, Waterloo, Ont., Canada). 1969. ANNULUS FORMATION ON SCALES OF THE WHITE PERCH, Morone americanus (Gmelin), IN THE BAY OF QUINTE, LAKE ONTARIO. Trans. Amer. Fish. Soc., 98(2): 322-326.

10720. Siefert, Richard E. (North Central Reservoir Invest., Bur. of Sport Fisheries and Wildlife, Yankton, S.D.). 1969. CHARACTERISTICS FOR SEPARATION OF WHITE AND BLACK CRAPPIE LARVAE. Trans. Amer. Fish. Soc., 98(2): 326-328.

10721. Swarts, William (State Univ. College, Geneseo, N.Y.). 1969. BLOOD STUDIES OF SOME MARINE TELEOSTS. Trans. Amer. Fish. Soc., 98(2): 328-331.

10722. Niggol, Karl (Bur. of Commercial Fisheries Biological Lab., Seattle, Wash.). 1969. THERMAL MARKING OF ADULT CHINOOK SALMON, Oncorhynchus tshawytscha. Trans. Amer. Fish. Soc., 98(2): 331-332.

10723. Hnath, John G. (Michigan Dept. of Conservation, Grayling Research Sta., Grayling, Mich.). 1969. TRANSFER OF AN ADULT ACANTHOCEPHALAN FROM ONE FISH HOST TO ANOTHER. Trans. Amer. Fish. Soc., 98(2): 332.

10724. McCann, James A., and Donna F. Cruse (Massachusetts Coop. Fish. Unit, Holdsworth Hall, Univ. of Massachusetts, Amherst, Mass.). 1969. COMPUTER PROGRAM FOR MARK AND RECOVERY POPULATION ESTIMATES (CDC 3600 COMPUTER). Trans. Amer. Fish. Soc., 98(2): 332-334.

10725. Groves, Alan B., and Irving W. Jones (Bur. of Commercial Fisheries Biological Lab., Seattle, Wash.). 1969. PERMANENT THERMAL BRANDING OF COHO SALMON, Oncorhynchus kisutch. Trans. Amer. Fish. Soc., 98(2): 334-335.

10726. Essbach, Alban R., and Riney Maxwell (Arizona Game and Fish Dept., Fish. Div., 1688 West Adams, Phoenix, Ariz.). 1969. A COLLAPSABLE FISH HOLDING CAGE. Trans. Amer. Fish. Soc., 98(2): 337-338.

10727. Jenkins, Thomas M., Jr., and Aaron Klain (Sierra Nevada Aquatic Res. Lab., Bur. of Sport Fisheries and Wildlife, Bishop, Calif.). 1969. A REGULATED-TEMPERATURE ELECTRIC TOOL FOR MARKING FISH. Trans. Amer. Fish. Soc., 98(2): 338-340.

10728. Fowler, Laurie G., and Joe L. Banks (Bur. of Sport Fisheries and Wildlife, Salmon-Cultural Lab., Longview, Wash.). 1969. TESTS OF VITAMIN SUPPLEMENTS AND FORMULA CHANGES IN THE ABERNATHY SALMON DIET, 1966-67. Bureau of Sport Fisheries and Wildlife Technical Paper 26. pp. 3-19.

The 1966 and 1967 diet trials at the Salmon-Cultural Laboratory indicated that fall chinook salmon fingerlings (Oncorhynchus tshawytscha) utilized an all-meal diet more efficiently when pelleted than when ricer fed. The abernathy pellet was comparable to the Oregon pellet. Supplemental vitamins C and E proved to be required under certain conditions of the experiment while vitamins K, para-amino-benzoic acid, B_{12}, cod liver oil, and a mineral mixture were not shown to be of benefit. When added as supplements, blood meal proved toxic and distiller's solubles, crab meal, and salt had no measurable effect. When substituted on an isoprotein basis hake meal was comparable to salmon meal, dried buttermilk was equal to dried skim milk, and a low-protein cottonseed meal was equal to a high-protein cottonseed meal. A protein level of 30 or 32.5 % seemed to be optimum under these test conditions. The use of rancid fish meals in the diet caused anemia and liver degeneration. These effects were eliminated by alpha tocopherol supplementation. (Authors)

10729. Vincent, Frederic. 1968. SPAWNING ECOLOGY OF THE WHITE BASS Roccus chrysops (Rafinesque) IN UTAH LAKE, UTAH. The Great Basin Naturalist, 28(2): 63-69.

10730. Dupree, Harry K. (Bur. of Sport Fisheries and Wildlife, Southeastern Fish Cultural Lab., Marion, Ala.). 1969. INFLUENCE OF CORN OIL AND BEEF TALLOW ON GROWTH OF CHANNEL CATFISH. Bureau of Sport Fisheries and Wildlife Technical Paper 27. pp. 3-13.

Fingerling channel catfish were offered a series of 18 purified diets that contained liquid corn oil, solid corn oil, and beef tallow at 4, 8, and 16% of the dry diet, and white dextrin at 8 and 16% of the dry diet. Effect of the dietary variables was based on proximate analysis for protein, ash, moisture, lipid, and iodine absorption number of the lipid of entire fish at the start and end of the experiment. Dietary fat when increased from 4 to 8% of the diet appeared to spare protein as reflected in greater protein deposition with the higher fat level. In the best diets, 1 gram of liquid of corn oil, of solid corn oil, and of beef tallow, respectively, spared 0.38, 0.73, and 0.27 grams of protein dry weight. A further increase in lipid content of the diets to 16% in all cases resulted in less protein deposition. Fat and protein in the tissues were altered by the level of dietary fat. Increasing the level of liquid corn oil, solid corn oil, and beef tallow from 4 to 16 % decreased the protein content of the tissues (dry weight) from 61.3 to 55.6, from 60.3 to 55.2, and from 60.2 to 50.3, respectively. Lipid content of the same tissues increased from 18.8 to 25.7, from 21.3 to 25.1, and from 16.6 to 20.7. Dextrin either at the 8 or 16% level had little effect on protein or fat content of the tissues. As the quantity of a dietary fat offered the fish was increased, the iodine number of deposited fat approached that of the ingested fat. Change was greater with diets that contained corn oil than beef tallow suggesting more efficient digestion and absorption of corn oil than beef tallow. (Auth.)

10731. Sanders, Herman O. (Bur. of Sport Fisheries and Wildlife, Fish-Pesticide Research Lab., Columbia, Mo.). 1969. TOXICITY OF PESTICIDES TO THE CRUSTACEAN Gammarus lacustris. Bureau of Sport Fisheries and Wildlife Technical Paper 25. pp. 3-18.

Static bioassays were conducted to determine the relative acute toxicities of some insecticides, herbicides, fungicides, and a defoliant to the scud Gammarus lacustris. Toxic effects were measured by determination of Median Lethal Concentration (LC_{50}) for 24-, 48-, and 96-hour exposures at 70° F. Organophosphate insecticides were generally more toxic than chlorinated hydrocarbon insecticides. There was a wide range in the toxicities of insecticides to scuds, with 24-hour LC_{50} values ranging from 0.32 micrograms per liter for coumaphos, an organophosphate insecticide, to 56,000 micrograms per liter for aldrin, a chlorinated hydrocarbon insecticide. Herbicides and fungicides were less toxic than most insecticides. DDT was 2.6 times as toxic at 70° F after a 48-hour exposure, and 7.0 times as toxic at the higher temperature after a 96-hour exposure. DDT was 5.7 times as toxic to 1-month-old animals as to 3-month-old animals after a 24-hour exposure. (Auth.)

10732. Mackiewicz, John S. (Univ. of Oklahoma Biological Station and the State Univ. of New York at Albany). 1968. TWO NEW CARYOPHLLAEID CESTODES FROM THE SPOTTED SUCKER, Minytrema melanops (Raf.) (CATOSTOMIDAE). J. Parasit., 54(4): 808-813.

Three species of caryophyllaeids were found in the spotted sucker, Minytrema melanops (Raf.)(Catostomidae) from Oklahoma and Alabama. Promonobothrium minytremi gen. et sp. n. most closely resembles Monobothrium Diesing but lacks the terminal introvert characteristic of that genus. Biacetabulum banghami sp. n., found also in the golden redhorse, Moxostoma erythrurum (Raf.), is distinguished from other species by having a pair of loculi and two pairs of papilliform processes on the scolex. Monobothrium ulmeri Calentine and Mackiewicz, occurred in conspicuous mucosal pits in the spotted sucker but was only weakly attached in the golden redhorse. Incidence, variation, and distributional data are presented for each species. (Auth.)

10733. Kritsky, Delane C., and Ronald P. Hathaway (Dept. of Zoology, Univ. of Illinois, Urbana, Ill.). 1969. NEW AND PREVIOUSLY DESCRIBED SPECIES OF DACTYLOGYRIDAE (MONOGENEA) FROM ILLINOIS FISHES. J. Parasit., 55(1): 143-148.

The following species of Monogenea from Illinois are comparatively or originally described: Lyrodiscus minimus sp. n. from Ambloplites rupestris (Rafinesque), Salt Fork of the Vermilion River near Oakwood; Pellucidhaptor angularis sp. n. and P. eremitus Rogers, 1967, both from Carpiodes cyprinus (LeSueur), Spoon River near Flatville; and Pseudomurraytrema copulatum (Mueller, 1938) and P. paradoxum sp. n. both from Hypentelium nigricans (LeSueur), Little Vermilion River near Sidell and Sangamon River near Mahomet. P. etowanum Rogers, 1966, is reported from H. nigricans, Little Vermilion River near Sidell. P. paradoxum is the first described species of Dactylogyridae to possess haptoral plaques (unarmed). (Authors)

10734. Tedla, Shibru, and C.H. Fernando (Dept. of Biology, Univ. of Waterloo, Waterloo, Ont., Canada). 1969. OCCURRENCE OF PLEROCERCOIDS OF Triaenophorus nodulosus (Pallas, 1781) IN THE WHITE PERCH Roccus americanus (Gmelin). J. Parasit., 55(2): 334.

10735. Schirone, Robert C., and Leo Gross (Waldemar Medical Research Foundation, Woodbury, N.Y.). 1968. EFFECT OF TEMPERATURE ON EARLY EMBRYOLOGICAL DEVELOPMENT OF THE ZEBRA FISH, Brachydanio rerio. J. Exp. Zool., 169(1): 43-52.

The early development of the zebra fish embryo, Brachydanio rerio (Hamilton) was studied under thermostatically controlled temperatures ranging from 13° to 35° C. Regular and successive cleavages and a distinct continuity of morphological features proceed regularly between 23° and 34° C. Embryos kept at temperatures above or below these limits did not complete embryogenesis. Embryogenesis up to late high blastula proceeded at the same rate of development over the temperature range of 24° C to 32° C. Time-lapse cinephotomicrography was utilized in a study of development from the one-celled blastodisc to the closure of the blastopore, incubated in a modified Rose culture chamber. The number of abnormal embryos was constant over the range of temperatures from 23° to 34° C. (Authors)

10736. Yamamoto, Toko-O, and Takao Kajishima (Biological Inst., Faculty of Science, Nagoya Univ., Nagoya, Japan). 1968. SEX HORMONE INDUCTION OF SEX REVERSAL IN THE GOLDFISH AND EVIDENCE FOR MALE HETEROGAMITY. J. Exp. Zool., 168(2): 215-222.

Methyltestosterone and estrone were administered orally to fry of the goldfish, Carassius auratus, daily for two months; thereafter, they were raised on a normal diet. All but one of the methyltestosterone-treated fish developed into males, while all estrone-treated fish developed into females. Of seven methyltestosterone-treated males mated with normal females, six produced progeny in a 1♀:1♂ ratio and the remaining one produced only females. Of eleven estrone-treated females mated with normal males, seven produced progeny in a 1♀:1♂ ratio and four yielded offspring in a ratio of 1♀:3♂. Induction of sex reversal in both directions by heterologous sex hormones was successfully accomplished. The sex ratios of the progeny of hormone-treated goldfish provide evidence that the male is heterogametic (XY). (Authors)

10737. Massaro, Edward J., and Clement L. Markert (Dept. of Biology, Yale Univ., New Haven, Conn.). 1968. ISOZYME PATTERNS OF SALMONID FISHES: EVIDENCE FOR MULTIPLE CISTRONS FOR LACTATE DEHYDROGENASE POLYPEPTIDES. J. Exp. Zool., 168(2): 223-238.

Starch gel electrophoretic and molecular hybridization studies indicate that the genomes of rainbow (Salmo gairdneri) and brown (S. trutta) trouts may code for eight electrophoretically distinct types of lactate dehydrogenase (LDH) subunits. The interactions of these subunits in vivo produce eighteen isozymes. These isozymes are naturally arranged into four groups, designated a, b, d, and e, on

the basis of physico-chemical properties. Groups a, b, and d each consist of five isozymes while group e is composed of three isozymes. An obvious tissue specific distribution of the isozyme groups is observed. Like the rainbow and brown trouts, other salmonids such as the Atlantic salmon (S. salar), sockeye (Oncorhynchus nerka), and bloater (Coregonus hoyi) possess numerous LDH isozymes. Also, we and others have detected an unusual multiplicity of molecular forms of other proteins in Salmonidae. Representatives of the Osmeridae, Clupeidae, Engraulidae, Argentidae, and Esocidae, which are closely related families, possess no more than five LDH isozymes. Moreover, salmonids contain twice as much DNA per cell and have karyotypes which show about twice as many chromosome arms as certain closely related forms. From these observations, it has been concluded that salmonids are tetraploids. In our view, it seems most likely that they arose through allotetraploidization of a primitive hybrid ancestor. (Authors)

10738. Ballard, William W. (Biology Dept., Dartmouth College, Hanover, N.H.). 1968. HISTORY OF THE HYPOBLAST IN Salmo. J. Exp. Zool., 168(2): 257-272.

Spots printed on the blastodisc of Salmo gairdneri with Nile blue sulfate prior to and during the formation of the germ ring and embryonic shield show during the morphogenetic movements that not many of the germ ring cells are derived from the center of the blastodisc. Evidence suggests that only a few of the loose round cells of the deep part of the ring and of the axial nubbin are produced by local dropout of cells at the margin of the blastodisc, but that most of them arrive there by outward migration from the outer two-thirds of the disc. The embryonic shield is produced by a convergence of internal cells that starts early in the fifth day at 10° C, augmented by a massive descent of consolidated internal cells from the central one-third of the blastodisc which then form the forebrain and optic vesicles. The cellular envelope is not involved in an invagination, nor does it take part in the general convergence movements. Chalk grains incorporated into the lower surface of the germ ring and the embryonic shield reveal the destination of the cells which carry them along. The hypoblast of the ring continues to converge toward the shield until the closure of the yolk plug on the ninth day. The epiblast of the ring meanwhile forms the cell layers of the yolk sac. Head mesoderm, pharynx endoderm and notochord materials are assembled directly into the embryonic shield while the germ ring is forming. Additional evidence is presented that these parts are not formed by invagination. Materials of the hypoblast originally placed as far as 90° out on the ring from the early shield reach the trunk endoderm, and materials from the hypoblast of the entire ring are passed along toward and into the somite and lateral plate strips. Their oblique paths of migration, combining both epiboly and convergence, are at marked angles to the simple epibolic paths of the epiblast cells, and it is suggested that the split between epiblast and hypoblast in the germ ring is a result of this shearing effect. (Auth.)

10739. Netboy, Anthony. 1969. ROUND TRIP WITH THE SALMON. Natural History, 78(6): 44-50, 66-67.

The life history of the Pacific salmons. Migrations and some theories of their ocean navigation.

10740. Parsons, T.R., K. Stephens, and R.J. LeBrasseur (Fish. Res. Bd. of Canada, Pacific Oceanographic Group, Nanaimo, B.C., Canada). 1969. PRODUCTION STUDIES IN THE STRAIT OF GEORGIA. PART I. PRIMARY PRODUCTION UNDER THE FRASER RIVER PLUME, FEBRUARY TO MAY, 1967. J. exp. mar. Biol. Ecol., 3(1): 27-38.

Primary productivity measurements have been carried out during the period, February to May 1967, at two places in the general vicinity of the Fraser River estuary. At one station within the Fraser River plume the average radiation in the mixed layer was sufficient to allow for a new positive production throughout the period of study. An approximate estimate of this production gives a value of 50 g C/m^2 produced during the four month study. At the second station, which was generally outside of the immediate influence of the Fraser River plume, the average radiation in the mixed layer was such that on only two occasions could any appreciable production have taken place. (Authors)

10741. Ballard, William W., and Lance Meredith Dodes (Biology Dept. and Dartmouth Medical School, Dartmouth College, Hanover, N.H.). 1968. THE MORPHOGENETIC MOVEMENTS AT THE LOWER SURFACE OF THE BLASTODISC IN SALMONID EMBRYOS. J. Exp. Zool., 168(1): 67-84.

Patterns of hitherto undescribed morphogenetic movements have been found in Salmo gairdneri and Salvelinus fontinalis by removing samples of blastodiscs from their yolk spheres at intervals of several hours and inspecting their lower surfaces. Before onset of epiboly, the former species usually produces no pregastrular subgerminal cavity, but the latter usually produces one or several, with wide variation. In both species the inner blastomeres consolidate from an earlier dispersed and migratory condition, forming a coherent flattened sheet 6 to 10 cells thick before active epiboly begins. As the first evidence of polarity in the salmonid embryo, one sector of the blastodisc becomes condensed and slightly thickened. Then a broad central area of the disc rapidly thins out as a result of two types of movement: (1) large numbers of cells disengage from the under surface of the condensed blastodisc, and they migrate away from the center as individuals and small groups; (2) the rest of the internal cells engage in a similar centrifugal movement toward the germ ring and the embryonic shield, but as a coherent sheet, sliding just within the cellular envelope. Some, perhaps all, of the disengaged cells of the first group are slowly gathered into the endoderm sheet. The coherent cells of the second group accumulate in germ ring and embryonic shield, where they become split temporarily into upper and lower sheets, the former adhering to the external layer, the cellular envelope, with which it forms the epiblast, and the latter associating with the disengaged cells as the hypoblast. The first internal sign of axis formation is a hitherto undescribed nubbin of cells attaching to the yolk syncytium at one sector on the inside of the blastodisc rim. The nubbin cells take no further part in the epibolic spread of the disc. It is suggested that they form an anchor for the later convergence movements from right and left, and that the whole pattern of movements from then on may be controlled by a gradient of increasing cell adhesiveness that spreads from them as a center. These nubbin cells have never been at the surface of the blastodisc. They neither invaginate nor migrate forward. They may represent the prechordal plate. (Authors)

10742. Parsons, T.R., R.J. LeBrasseur, J.D. Fulton, and O.D. Kennedy (Fish. Res. Bd. of Canada, Pacific Oceanographic Group, Nanaimo, B.C., Canada). 1969. PRODUCTION STUDIES IN THE STRAIT OF GEORGIA. PART II. SECONDARY PRODUCTION UNDER THE FRASER RIVER PLUME, FEBRUARY TO MAY, 1967. J. exp. mar. Biol. Ecol., 3(1): 39-50.

Secondary productivity measurements have been carried out during the period February to May, 1967 in the general vicinity of the Fraser River estuary. The quantity of phytoplankton grazed by zooplankton in the area was measured in incubated samples and the results show that both the quantity and type phytoplankton caused considerable changes in the amount of food eaten by the zooplankton. Grazing was found to start at threshold phytoplankton levels of between ~50-190 µg C/l and maximum grazing was found to occur at phytoplankton concentrations of ~400 µg C/l. The larger phytoplankton species were generally grazed in greater quantities than the smaller species. From in situ observations the quantity of Calanus plumchrus produced during the investigation approximated to the amounts predicted from estimates of the growth rate of this organism. These results indicate that the large standing stock of zooplankton which developed in the vicinity of the Fraser River estuary resulted from the presence of adequate concentrations of the right size and shape of food organisms and from a lack of severe predation on the early growth stages of this copepod. (Authors)

10743. Dumont, Henri J. (Zoological Inst., Ghent, Belgium). 1968. A STUDY OF A MAN-MADE FRESHWATER RESERVOIR IN EASTERN FLANDERS (BELGIUM), WITH SPECIAL REFERENCE TO THE VERTICAL MIGRATION OF THE ZOOPLANKTON. Hydrobiologia, 32(Fasc. 1-2): 97-144.

10744. LeBrasseur, R.J., W.E. Barraclough, O.D. Kennedy, and T.R. Parsons (Fish. Res. Bd. Canada, Pacific Oceanographic Group, Nanaimo, B.C., Canada). 1969. PRODUCTION STUDIES IN THE STRAIT OF GEORGIA. PART III. OBSERVATIONS ON THE FOOD OF LARVAL AND JUVENILE FISH IN THE FRASER RIVER PLUME, FEBRUARY TO MAY, 1967. J. exp. mar. Biol. Ecol., 3(1): 51-61.

Studies on larval (< 30 mm) and juvenile (> 35 mm) fish have been carried out in the vicinity of the Fraser River estuary during the same period in which studies were made on the primary and secondary production of the area. From feeding experiments and in situ concentrations of prey it is concluded that the food supply for juvenile fish in this area was abundant during the period of the investigation. For larval fish, however, there is some evidence that the quantity of microzooplankton available was at marginal concentrations for survival. (Authors)

10745. Blaxter, J.H.S. (Natural History Dept., Univ. of Aberdeen, Scotland). 1968. LIGHT INTENSITY, VISION, AND FEEDING IN YOUNG PLAICE. J. exp. mar. Biol. Ecol., 2(3): 293-307.

Young plaice of different ages have been obtained from rearing experiments. Histological examination of the eye shows that there are no rods in the retina, nor are there any retinomotor phenomena. At metamorphosis the rods appear and, at the same time, the characteristic movements of the retinal masking develop. Judging by histological criteria dark- and light-adaptation occurs between 1 and 0.01 m.c. Experiments, using Artemia nauplii as food, show that feeding is dependent on light. In young larvae the threshold light intensity for feeding (taken as 10% feeding) is 10-1.0 m.c. There is an increase in sensitivity with age; at metamorphosis the threshold was 0.01 m.c. Though there were differences in experiments undertaken over three years, there was, in metamorphosed individuals, a residual level of feeding in the dark due to the operation of some other sense. Metamorphosed plaice with abnormal body pigmentation, a fairly common feature of rearing experiments, did not show impaired vision or lack of retinal masking pigment. Measurements of underwater illumination in Loch Ewe, a nursery ground for plaice, between March and July, showed that the threshold for young larvae was reached at about Civil Twilight and for metamorphosed plaice a little before Nautical Twilight. This makes it possible to calculate the hours available for feeding at different levels in each period of 24 hours as the season progressed. considerable advantages might be expected to accrue to late-spawned larvae, both in terms of day length and temperature, resulting in improved growth, assuming that food is not a limiting factor. (Auth.)

10746. Potts, W.T.W., and P.P. Rudy, Jr. (Dept. of Biological Sciences, Univ. of Lancaster, St. Leonard's House, Lancaster, England). 1969. WATER BALANCE IN THE EGGS OF THE ATLANTIC SALMON Salmo salar. J. Exp. Biol., 50(1): 223-237.

The rate of exchange of tritiated water across the vitelline membrane of the eggs of the Atlantic salmon has been examined under various conditions. In eggs shed into isosmotic saline the rate constant of exchange is about 0.3-0.4/hr. When eggs are shed into distilled water or isosmotic glucose rate constants as high as 0.8-1.0/hr. occur for short periods but the rate of exchange declines rapidly. Low concentrations of sodium and more especially of calcium ions delay both the phase of rapid exchange and the phase of declining permeability. The rate of formation of perivitelline fluid is greatest during the period of high permeability. (Authors summ.)

10747. Koeman, J.H., M.C. Ten Noever de Brauw, and R.H. De Vos (Inst. of Veterinary Pharmacology and Toxicology, Utrecht, Netherlands). 1969. CHLORINATED BIPHENYLS IN FISH, MUSSELS AND BIRDS FROM THE RIVER THINE AND THE NETHERLANDS COASTAL AREA. Nature, 221(5186): 1126-1128.

Polychlorinated biphenyls are widely used in industry, and they are now making an appearance in the world's wildlife. Besides being a hazard in their own right, they interfere with the detection of organochlorine insecticides such as DDT.

10748. Reichenback-Klinke, H. 1969. KEY TO THE DETERMINATION OF THE DIAGNOSIS OF FISH DISEASES. (Bestimmunsschlüssel zur diagnose von fischkrankheiten). Gustav Fischer Verlag, Stuttgart, Germany, 64 pp. (In German), 6 marks ($1.51).

The main part of this handbook consists of a key to the identification of fish diseases, using the symptoms and signs of disease. Utilized are the symptoms of movement, color changes, nutritional habits, gross shape, skin, gills, body cavity, alimentary system, liver, gall bladder, pancreas, spleen, kidney, urinary organs, heart, blood vessels, muscle, skeleton, nervous system, eggs and embryos. Included are: instructions for preparing an investigation report, a chart of the symptoms of bacterial diseases, a table of medications and instruction for submitting sick fish. Also included are: a key to European freshwater fishes, illustrations of common fish parasites and a labelled plate of external fish anatomy. --G. L. Hoffman.

10749. Rudy, P. P., Jr., and W. T. W. Potts (Dept. of Biological Sciences, Univ. of Lancaster, St. Leonard's House, Lancaster, England). 1969. SODIUM BALANCE IN THE EGGS OF THE ATLANTIC SALMON, Salmo salar. J. Exp. Biol., 50(1): 239-246.

Exchanges of sodium ions between the egg of the salmon and the environment have been examined at different stages. In freshly stripped eggs and during the early stages of development exchange is confined to the chorion and perivitelline fluid. The perivitelline fluid can accumulate sodium to several times the ambient concentration probably by a Donnan effect associated with its protein content. At low external concentrations the relative accumulation is lower than the Donnan theory predicts. Sodium accumulation begins during the eyed stage and accelerates after hatching. (Authors summ.).

10750. Birkett, L. 1969. THE NITROGEN BALANCE IN PLAICE, SOLE AND PERCH. J. Exp. Biol., 50(2): 375-386.

Plaice, sole and perch were fed on live food for 20-40 days, and their growth rates were compared with their rates of absorption, both measured as mg N/g live weight/day. The gross efficiency of nitrogen conversion—that is, the growth per unit of nitrogen absorbed in excess of maintenance—was between 27.5% and 49.0%. The maintenance rate of absorption was between 0.173 and 0.499 mg N/g/day. The basal rate of excretion amounted to 0.056-0.208 mg N/g/day. At maintenance, total excretion is equal to the amount of nitrogen absorbed from the food. The metabolic cost of growth was 1.04-2.64 mg N excreted per mg N retained. (Auth. summ.)

10751. Ouellette, R. P., and S. U. Qadri (Mass. Gen. Hosp., Boston, Mass.). 1966. PRINCIPAL COMPONENT ANALYSIS AND PATTERN OF GROWTH IN Cristivomer namaycush. Growth, 30(3): 285-293. Illus.; Biological Abstracts, 48(24): Abst. No. 120085. 1967.

The latent roots extracted from a correlation matrix based on 43 measurements taken on C. namaycush are evaluated. A principal components solution is given to the multivariate problem of growth. The following conclusions are drawn: apparently 78.27% and 73.61% of the variation for the males and females, respectively, is explained by general size factor; all other minor axes correspond to disjoint or trivial variation of the various characters; in spite of a certain sexual dimorphism, the magnitude of the variance and the percentage of the variation explained by each root are comparable in both sexes; and the proposed solution is a general one for the family Salmonidae since it applied equally to the 5 spp. studied. (Authors)

10752. Voinarovich, Elek. 1959. THE ASPECT OF THE BIOLOGICAL PRODUCTIVITY OF LANDLOCKED RESERVOIRS AND THEIR ECONOMIC VALUE. (Voprosy khozyaistvenno tsennoi produktsii zamknutykh, stoyachikh vodoemov s tochki zreniya produktsionnoi biologii). In: Proc. of the Sixth Conf. on Biological Problems of Inland Waters, 1957. Akad. Nauk SSSR: Moscow-Leningrad. 105-113. Ref. Zhur., Biol., 1960, No. 79738. (Translation); Biological Abstracts, 48(24): Abst. No. 120229. 1967.

Based on Maukh's theory which defines the productivity of a water reservoir as "the maximum conversion of solar energy to potential energy, by the developing organisms, in optimal conditions, in a unit of time", the general problems of reservoir productivity are discussed. Differentiation of the water-dwelling organisms into accumulating, constructing and decomposing organisms, instead of consumers, producers and reducers as previously used, expresses, more correctly their biological productive activity. A study of the potential economic value of the reservoirs was carried out, whereby the directed transformations of matter and energy of the ecosystem and the conditions for primary and secondary productivity of the reservoirs are evaluated. Various effectiveness of the primary production utilization in connection with the population composition of the reservoir is discussed. Examples are quoted of the increase in valuable production by way of acclimatization of commercial fauna in Lake Balaton and others. --Courtesy NSF (PL 83-480) 1963.

10753. Goncharov, G.D. 1959. PICTURE OF THE BLOOD OF THE BREAM (Abramis brama) AS INDICATOR OF ITS PHYSIOLOGICAL CONDITION IN THE KAMA RESERVOIR IN FALL 1957. (Kartina krovi leshcha kak polazatel' fiziologicheskogo ego sostoyaniya v Kamskom vodokhranilishche osen'yu 1957 goda). Byul. Inst. Biol. Vodokhran. Akad. Nauk SSSR 4. 41-43; Ref. Zh., Biol., 1960, No. 66269. (Translation); Biological Abstracts, 48(24): Abst. No. 120322. 1967.

Toxic industrial sewage is being discharged into the northern part of the Kama Reservoir. In this region, Hb content of the blood in females of A. brama is 42-65%, and in males 44-66%. The relative percentage of granulocytes is 47-73%. The water of the Gorki Reservoir is less polluted. The blood of females of A. brama from this contains 41-55% Hb and that of the males contains 43-53% Hb. The percentage of granulocytes in 27-58%. --Courtesy NSF (PL 83-480) 1963.

10754. Cuerrier, J.-P., J.A. Keith, and E. Stone (Can. Wildlife Serv., Ottawa, Ont., Canada). 1967. PROBLEMS WITH DDT IN FISH CULTURE OPERATIONS. Natur. Can., 94(3): 315-320. (Fr. summ.); Biological Abstracts, 48(24): Abst. No. 120344. 1967.

Various concentrations of DDT and residues have been detected in eggs and fry of speckled, rainbow, and cutthroat trout obtained from local sources and from commercial suppliers and handled at the Maligne River Trout Hatchery, Jasper National Park, Alberta. Concentrations of DDT and metabolites exceeding 400 ppb (parts per billion) in eggs resulted in a 30 to 90% mortality among the fry during the days following the swim-up stage. All commercial dry feeds analyzed contained DDT. Among ingredients used in the manufacturing of trout feeds, only brewer yeast was found almost free of contamination. (Authors)

10755. Elson, P.F., and C.J. Kerswill (Fish. Res. Board Can., Biol. Sta., St. Andrews, N.B., Canada). 1967. DEVELOPING CRITERIA FOR PESTICIDE RESIDUES IMPORTANT TO FISHERIES. In: Background papers prepared for the National Conference on pollution and our environment, Vol. 3, Oct. 31 - Nov. 4, 1966, Montreal, Que., Can., Canadian Council of Resource Ministers: Montreal, Que., Can. C22-3-3.

New Brunswick forest spraying programs have had a damaging impact on Atlantic salmon production from sprayed streams. With early programs nearly all young of the year were killed and lesser proportions of older pre-migrant fish. Aquatic insects, food of young salmon, were also killed in large numbers and did not recover their original abundance of species for 4 or more years. Adult stocks and fisheries based on sprayed young were reduced. But the effect of a single year's spraying was spread over several years of returning adult stocks, thus being less dramatic than the reduction of young. Methods for assessing damage to fisheries and spawning stocks have been developed and tested. There is need for developing better criteria for evaluating effects of pesticide residues in the aquatic environment. Future development is suggested in 2 broad areas: direct effects of pesticide use on fish and fisheries, and measurement, by chemical analysis, of residues in appropriate niches of fisheries environments. Suggested approaches

are: for direct effects on fisheries, improved background information on natural production of fish, including, for example, life histories for specific areas, productive capacities, water quality characteristics, the roles of genetic and environmental factors in placing stocks where they will be useful to fisheries; development of techniques for assessing direct effects of spray on fish. These might include further improvement of techniques for placing and holding very young fish in sprayed and control areas and determination of some areas to be treated sufficiently far in advance that pre-spray population assessments are practical. There is need for improved assessment of post-spray delayed mortality. Studies of sublethal effects on the behavior and physiology of fish, including reproduction, should be increased. In determination by chemical analysis of pesticide residues: Studies like those listed earlier should be combined with chemical analysis of residues in the fish. Chemical analyses of residues in the environment, especially at points where increasing degrees of biological concentration are to be expected, should be undertaken. They should also be designed to bring out the effects of repeated pesticide use, as well as effects of residues several years later. (Authors)

10756. Isaev, A. 1959. CULTIVATION OF SALMON IN SWEDEN. (Vosproizodstvo lososya v Shvetsii). Rybovodstvo i Rybolovstvo 5. 53-55; Ref. Zh., Biol., 1960, No. 61086. (Translation); Biological Abstracts. 48(24): Abst. No. 120361. 1967.

Annually 15 hatcheries incubate 15 million eggs of salmonid fishes and produce 56,000 2-year-old salmon weighing 20-30 g. Eggs are obtained from sexually mature females by means of a double-walled rubber sac into which air is pumped. --Courtesy NSF (PL 83-480) 1963.

10757. Kostomarova, A.A. 1959. BIOLOGICAL IMPORTANCE OF THE PHASE OF MIXED NOURISHMENT FOR THE DEVELOPMENT OF THE LARVAE OF THE PIKE (Esox lucius). (Biologicheskoe znachenie etapa smeshannogo pitaniya dlya razvitiya lichinok shchuki). Rybn. Khoz. 8. 25-27. (Translation); Biological Abstracts, 48(24): Abst. No. 120367. 1967.

Larvae of the pike E. lucius start ingesting food independently 9-10 days after hatching. Their length is then 12.5-13 mm. The resorption of yolk is accomplished in this stage of mixed nourishment. Larvae pass to the next developmental stage when they reach a length of 15 mm. Lack of external food in the stage of mixed nourishment retards growth and development and provokes pathological changes in the digestive tract. Additional feeding of artificially bred pike should be started 48 hours after the larvae become mobile. --Courtesy NSF (PL 83-480) 1963.

10758. Lacroix, Guy (Sta. Biol. Mar., Grand-Riviere, Que., Canada). 1967. NOCTURNAL AND DIURNAL VERTICAL DISTRIBUTION OF THE CODFISH (Gadus morhua) AT THE MOUTH OF CHALEUR BAY. Natur. Can., 94(3): 283-296; Biological Abstracts, 48(24): Abst. No. 120368. 1967.

Observations on diurnal and nocturnal distribution of cod were made in the Grande-Riviere area (Baie-des-Chaleurs) from early July to late August in 1958-1959, with floating long-lines at 15-18 m and 30-36 m from the bottom, in comparison with bottom long-lines. Only a few cod were caught by the diurnal floating long-lines, but frequently samples of fish were taken by the nocturnal floating long-lines. In some cases (August 1959) many more cod were caught by the nocturnal floating long-lines than by the bottom lines. Our results clearly suggest that in some periods summer cod of the area remain on bottom or close to bottom by day and move in midwater layers at night. Most of the cod migrating upwards were presumably mature fish (51-70 cm), but slightly smaller fish were caught on the floating lines than on the bottom lines. Nevertheless, notable differences were observed between the stomach contents of the bottom cod and of midwater cod. Many important benthic preys (true crabs, hermit crabs, benthic fishes) are completely absent from the stomach contents of the midwater cod and the proportion of empty stomachs was peculiarly high as compared with that of benthic cod. Such data are regarded as circumstantial evidence of the reliability of floating lines. A coincidence between a sharp and deep thermocline and the maximum vertical ascent of cod was revealed; but a substantiated explanation cannot be offered at present. (Auth.)

10759. Neave, Ferris, Teruo Ishida, and Sueto Murai (Fish. Res. Board Can., Biol. Sta., Nanaimo, B.C., Canada). 1967. SALMON OF THE NORTH PACIFIC OCEAN. VII. PINK SALMON IN OFFSHORE WATERS. Int. N. Pac. Fish. Comm., 22. 1-39. Illus. Maps; Biological Abstracts, 48(24): Abst. No. 120380. 1967.

This bulletin contains Part VII of the comprehensive report entitled Salmon of the North Pacific Ocean, which is being prepared and published by the International North Pacific Fisheries Commission. The comprehensive report was described in detail in its introduction, which appeared in Part I (INPFC Bulletin No. 12, 1963). The various parts of the comprehensive report are being published separately as they become available and not necessarily in numerical order. Those parts which have been published thus far are listed overleaf. Part VII consists of a description of the oceanic distribution of specific stocks of pink salmon on the high seas and the intermingling of these stocks. It has been written jointly by authors representing the 3 national sections of the Commission. Research reports submitted to the Commission for publication in the bulletin series must first receive approval for publication from 3 scientific referees. These referees are Mr. Aiji Takashiba, Chief of the Research Division of the Fisheries Agency of Japan; Mr. Donald L. McKernan, U.S. Department of State; and Dr. W.E. Ricker, Acting Director of the Biological Station, Nanaimo, B.C., of the Fisheries Research Board of Canada. Following approval for publication by the scientific referees, papers must receive approval for publication by the Commission. Bulletins of the Commission are published separately in English and Japanese. The original language of each paper is indicated and accuracy of translation is the responsibility of the Secretariat. (Authors)

10760. Sprague, J.B., and C.P. Ruggles (Res. Board Can., Biol. Sta., St. Andrews, N.B., Canada). 1967. IMPACT OF WATER POLLUTION ON FISHERIES IN THE ATLANTIC PROVINCES. In: Background papers prepared for the National Conference on pollution and our environment, Vol. 1, Oct. 1 - Nov. 4, 1966, Montreal Que., Can., Canadian Council of Resource Ministers: Montreal, Que., Can. A4-1-22; Biological Abstracts, 48(24): Abst. No. 120395. 1967.

The 4 Atlantic Provinces of Canada have a population of 2 million people and an economy heavily dependent on natural resources including commercial and sport fisheries. Freshwater fish are damaged by several kinds of pollution, of which pesticides seem to be the most widespread. A large aerial forest-spraying program killed 50% to 98% of young salmon in affected streams. Pulp mill and mine wastes create lethal conditions in some stretches of fresh water and threaten to block fish migration through some estuaries. Along the sea coast, sewage contamination has made 20% or more of present shellfish stocks unfit for marketing. Silting threatens the most productive oyster-growing areas. Growth of the $125 million fish processing industry is severely handicapped by the expense of finding enough pure processing-water. Spectacular progress has been made by 2 provincial Water Authorities. They have coordinated other agencies and stimulated waste control. Two more provincial authorities are being created. However, improvements in pollution control must be much more abrupt if the region is to preserve its freshwater fish, shellfisheries, and fish-processing industry. (Authors)

10761. Strel'tsova, S.V., and G.N. Bogdanov. 1958. CHANGES OF RESPIRATION AND HEMATOLOGICAL FEATURES IN WINTERING CARP. (Izmenenie dykhaniya i pokazatelei krovi za zimovki karpov). Tr. Soveshch., Ikhtiol. Komis. Akad. Nauk SSSR 8. 271-277; Ref. Zh., Biol., 1960, No. 35228. (Translation); Biological Abstracts, 48(24): Abst. No. 120397. 1967.

Specimens of fry-of-the-year and of common carp and its hybrids crossed with the Amur wild carp, were kept for a long period at temperatures from 0.1-1.5° C. Physiological characteristics and changes in respiration and the hematological features were studied. The O_2 consumption decreased by the end of April, in carp by 73-50% and in hybrids by 71-33%. This decrease occurred earlier in smaller than in larger fish. No considerable changes were found in the blood Hb level. The effect of low temperatures is most pronounced in carp and

hybrids of less than 20 g in weight. At 0.2° C the intensity of respiration decreased considerably, by 24.1% and at 1° C only by 7.5%. The CO_2 level was higher in specimens kept for a long time at 0.2-0.3° C. All the indexes indicating deteriorated condition of fry-of-the-year during wintering (decrease in the intensity of respiration increased CO_2 level in blood, decrease in the number of erythrocytes) were more pronounced in fish wintering at 0.2-0.3° C than in fish wintering at temperatures above 1° C. Thus temperatures above 1° C are more favorable for wintering. --Courtesy NSF (PL 83-480) 1963.

10762. Pegel, V.A., V.A. Remorov, and V.V. Lopukhova. 1966. THE METABOLIC RESPONSE OF VARIOUS FRESHWATER TELEOSTS TO CHANGES IN WATER PRESSURE. (Reaktsiya obmena veshchestv u raznykh vidov presnovodnykh kostistykh ryb na izmenenie davleniya vody). In: Report Summaries of the All-Union Conference on the Ecology and Physiology of Fishes, 1966. Moscow. 34-35. From: Ref. Zh., Biol., 1967, No. 2I91. (Translation); Biological Abstracts, 48(24): Abst. No. 120847. 1967.

A study was made of the gaseous metabolism of conditioned-reflex activity and of some blood characteristics of Siberian dace, gudgeon, perch and crucian carp at various hydrostatic pressures throughout the year. In summer, at 2 and 4 atmospheres of additional pressure, the O_2 uptake rate and the excretion of CO_2 increased; in winter the O_2 uptake decreased, whereas the excretion of CO_2 rose sharply at the beginning of the experiment. In winter the conditioned reflex was not affected by 1.2-1.5 additional atmospheres, but it was disrupted in winter by only 0.5-0.8 additional atmospheres. At 1.1-1.3 additional atmospheres all the reflexes vanished. Blood characteristics changed little. (Authors)

10763. Faktorovich, K.A. 1966. LIPID METABOLISM CHARACTERISTICS IN THE LIVER OF SOME SPECIES OF THE GENUS Salmo IN RELATION TO DIFFERENCES IN THEIR LIFE HISTORIES. (ACCORDING TO HISTOLOGICAL STUDIES). (Ob osobennostyakh zhirovogo obmena v pecheni nekotorykh vidov roda Salmo v svyazi s razlichiyami ikh biologii. (Po dannym gistologicheskogo issledovaniya). In: Report Summaries of the All-Union Conference on the Ecology and Physiology of Fishes, 1966. Moscow. 36-37. From: Ref. Zh., Biol., 1967, No. 2I92. (Translation); Biological Abstracts, 48(24): Abst. No. 120862. 1967.

During the yolk- and mixed-feeding stages the fat content in the liver cells of rainbow trout, brook trout, Baltic and Atlantic salmon is similar. After the fish pass to external feeding, differences in fat content are observed which are correlated with the ecology of these species. Fat content in liver cells changes considerably in Baltic and Atlantic salmon that perform long spawning migrations during which they do not eat; in trout it changes little.

10764. Cartier, Denis, and Etienne Magnin (Dept. Biol., Univ. of Montreal, Montreal, Que., Canada). 1967. DEVELOPMENT OF GENITAL GLANDS IN Amia calva FROM THE MONTREAL AREA. (Developpement des glandes genitales des Amia calva L. de la region de Montreal). Natur. Can., 94(4): 381-387; Biological Abstracts, 48(24): Abst. No. 121479. 1967. (Engl. summ.).

During the juvenile period, one cannot distinguish male gonads from female ones by macroscopic examination. Well differentiated ovaries and testes could be observed under the microscope in a 221 mm and 236 mm specimen, respectively. The morphological and histological features of mature gonads were studied during the spawning time and also during the time interval between 2 successive spawning seasons. The male bowfins (Amia calva L.) from the Montreal area are sexually mature at the age of 4 years and the females attain their maturity at 4 or 5 years of age. (Authors)

10765. Kangur, A.K. 1966. ON THE SEASONAL DYNAMICS OF PROTEINS, NITROGEN EXTRACTS AND MUSCLE ADENOSINE TRIPHOSPHATASE (ATPase) ACTIVITY OF SOME LAKE VYRTSYARV (ESTONIAN SSR) FISHES. (O sezonnoi dinamike belkov, azotistykh ekstraktivnykh veshchestv i adenozintrifosfataznaya (ATFaznaya) aktivnost' myshts u nekotorykh vidov ryb ozera Vyrts''yarv (Eston-

ian SSR) fishes). In: Report Summaries of the All-Union Conference on the Ecology and Physiology of Fishes, 1966. Moscow. 40-41. From: Ref. Zh., Biol., 1967, No. 2I95. (Translation); Biological Abstracts, 48(24): Abst. No. 121621. 1967.

Biochemical characteristics of muscles of bream, pike-perch, pike, and perch were examined before, after and during the breeding season. Protein and nitrogen extract levels were highest during both the pre-spawning and spawning periods. Muscle ATPase activity diminished during spawning. Specific biochemical characteristics were noted.

10766. Eisler, Ronald (Fed. Water Pollut. Contr. Admin., Natl. Mar. Water Qual. Lab., West Kingston, R.I.). 1967. VARIATIONS IN MINERAL CONTENT OF SANDBAR SHARK VERTEBRAE (Carcharhinus milberti). Natur. Can., 94(3): 321-326. Illus. (Fr. summ.); Biological Abstracts, 48(24): Abst. No. 121655. 1967.

Cervical vertebrae from three length-frequency groups of Carcharhinus milberti were ashed and assayed for Ca, Fe, Mg, Zn, Na and K. These six metals constituted 28.4% of the total ash weight in samples from the smallest (mean total body length 64 cm) size groups of sharks, but only about 10% from both medium (129 cm) and from large (209 cm) sharks. Small sharks contained about three times more Ca per sample than either medium or large sharks and this would account for differences in mineral content among groups. The concentrations of both Na and K were similar in all size groups. Those of Zn and Fe on the other hand, were highest in small sharks and lowest in large sharks, while the reverse was true for Mg. Studies of the elementary chemical composition of vertebrae may be useful in evaluating the rates and processes of elasmobranch aging. (Auth.)

10767. Iskov, M.P., and V.P. Koval'. 1965. PARASITE FAUNA OF THE FISH OF THE KAKHOVSKOE RESERVOIR 8 YEARS AFTER ITS FILLING WITH WATER. (Parazitofauna ryb Kakhovskogo vodokhranilishcha cherez 8 let posle ego napolneniya). In: Parasites and parasitoses of man and animals. Nauk. dumka: Kiev. 192-207. From: Ref. Zh., Biol., 1966, No. 2K8. (Translation); Biological Abstracts, 48(24): Abst. No. 124585. 1967.

Studies were made of the parasite fauna of fish in the Kakhovskoe Reservoir in both its upper and lower reaches. Seventy-nine species of parasites were found of which 41 proved to be common to both regions investigated. Some protozoa (Glugea luciopercae), trematodes (spp. of the genus Allocreadium, Metagonimus yokogawai, Neascus cuticola), and tapeworms (Silurotaenia siluri) were confined to only the upper reaches of the reservoir. The most dangerous parasites are: Glugea luciopercae, spp. of the genera Diplostomulum and Cotylurus, Bothriocephalus gowkongensis, Ergasilus siebioldi, Tracheliastes maculatus, Ligula intestinalis, Digramma interrupta, Henneguya cutanea longicauda. Detailed data (17 tables) on the parasites of 16 species of fish and the intensity and extent of their infection are given.

10768. Laubier, Lucien, Claude Mallard, and Guy Oliver (Lab. Arago, Banyuls-sur-Mer, France). 1966. CONTRIBUTION TO THE STUDY OF PARASITES OF THE GRAY SHARK: Hexanchus griseus (Bonnaterre, 1788). (Contribution a l'etude des parasites du griset: Hexanchus griseus). Vie Milieu, 17(3A): 1197-1199; Biological Abstracts, 48(24): Abst. No. 124628. 1967.

Two species of Cestoda, 2 of Monogenea one of Trematoda and 2 of Copepoda were found. Two of these species are new for science: Erpocotyle taschenbergi, nom. nov. (Monogen) and Protodactylina pamelae, gen. et sp. nov. (Copepoda: Eudactylinidae). (Auth. summ. transl.)

10769. Priegel, Gordon R. 1968. MOVEMENT AND HARVEST OF TAGGED NORTHERN PIKE RELEASED IN LAKE POYGAN AND BIG LAKE BUTTE DES MORTS. Wisconsin Department of Natural Resources Research Report Fisheries No. 29. 7 p.

10770. Dufour, D., and D. Barrette (Centre Biomed., Univ. Laval, Laval, Que., Canada). 1967. POLYMORPHISM OF SERUM LIPOPROTEINS AND GLYCOPROTEINS IN THE TROUT. (Polymorphisme des lipoproteines et des glycoproteines seriques chez la truite). Natur. Can., 94(3): 305-313. Illus. (Engl. summ.); Biological Abstracts, 48(24): Abst. No. 124984. 1967.

There are important differences among the serum proteins of 3 different spp. of trouts. These genetic variations concern the lipoproteins as well as the glycoproteins. Furthermore, 3 serum proteins of Esox lucius have antigenic determinants common with the serum proteins of Salmo gairdneri; they are: one alpha2-lipoprotein, one alpha2-glycoprotein and one gamma-globulin. (From auth.)

10771. Pegington, C.J., and H. Rees (Dept. Agr. Bot., Univ. Coll. Wales, Aberystwyth, Wales, UK). 1967. CHROMOSOME SIZE IN SALMON AND TROUT. Chromosoma, 21(4): 475-477. Illus.; Biological Abstracts, 49(1): Abst. No. 262. 1968.

The chromosomes of the Atlantic salmon, Salmo salar (2n=58) are, on average, larger than those of the trout, S. trutta (2n=80). If the difference in chromosome size represents a permanent change in chromosome structure as between the 2 species the expectation is that the size difference between salmon and trout chromosomes will be maintained in the hybrid. If, alternatively, the size difference between salmon and trout chromosomes is genotypically determined the difference will not be maintained in nuclei of hybrid genotype. Measurements of a specific chromosome, S, of the salmon complement and of another, S^1, of the trout complement in nuclei of parent species and of the hybrid show that the difference in size is maintained in hybrid nuclei. The size difference between salmon and trout chromosomes is due to structural change rather than to genotypic control. (Authors)

10772. Bridges, David W., and John M. Neuhold (Bur. of Sport Fisheries and Wildlife, Sandy Hook, N.J.). 1966. BROWN TROUT SURVIVAL AND MOVEMENTS IN THE LOGAN RIVER [Salmo clarki lewisi, Salmo gairdneri irideus, Prosopium williamsoni]. Proc. Utah Acad. Sci. Lett., 43(Part 1): 67-82. Illus.; Biological Abstracts, 49(1): Abst. No. 875. 1968.

The number of brown trout is somewhat variable until the fish reach a length of 14 inches at which time the number stabilizes between years. Brown trout move downstream more than upstream at spawning time. Brown trout which had been marked in the river spawned in all areas including the tributary to the study area of Logan River. The rainbow trout "put and take" fishery is operating at about the same level of efficiency that it was 15 years ago. The superimposed rainbow population probably does not compete with brown trout during the winter months. The annual survival of the 1958 year-class of brown trout is affected by time and apparently fishing pressure. Increased survival after fishing season apparently compensated for the loss of large fish due to selective harvesting of older and larger fish by angling. The annual survival of 3-year-old and older brown trout decreased at about the same rate in 1961 as in 1962. The decrease could be the result of normal population fluctuation. (Authors)

10773. Gaudet, J.L. (Fish. Off., Inland Fish. Br., Food and Agr. Organ., Rome, Italy). 1967. THE STATUS OF WARM-WATER POND FISH CULTURE IN EUROPE. In: Proc. of the World Symposium on Warm-Water Pond Fish Culture. FAO Fish. Rept., 2(44): 70-87; Biological Abstracts, 49(1): Abst. No. 884. 1968.

In the European region, fish culture in warm-water ponds goes back to the Middle Ages and, in France and Spain particularly, was closely tied to religious practices of the time. By scientific management and careful selection, it is now possible to obtain yields as high as 3500 kg/ha for carp. The experimental culture of cold-water species such as trout, in water having a temperature of between 26.9° C and 29° C also give interesting results in Spain. Although the purpose of fish culture in Europe is often restocking natural waters for sport and commercial fisheries, much intensive fish culture, oriented primarily towards food production is also carried out. Artificial feeding is widely practiced. Gains obtained by feeding are hard to determine but in Israel, of 2000 kg of fish obtained per hectare,

probably 400 kg come from natural food, 400 kg more from fertilizers and 1200 kg from artificial feeding. The food coefficient varies with the size of fish, so advanced methods require the sampling of the weight and rate of growth of the fish regularly. Stocking material usually come from each country's own production, although new species are sometimes imported. In most European countries, governmental assistance is given to fish culturists, either through the establishment of research institutes and experimental stations or in the form of direct financial assistance. In eastern Europe, the governments act as the central planning agencies for fish culture development. The main problems facing warm-water fish culture in Europe are the inadequacy of water supplies, particularly in Poland and Israel, water pollution, and fish diseases in western Europe. A list of species used for warm-water fish culture in Europe is given. (Auth.)

10774. Maloy, Charles R. (Bur. of Sport Fisheries and Wildlife, Washington, D.C.). 1967. STATUS OF FISH CULTURE IN THE NORTH AMERICAN REGION. In: Proceedings of the World Symposium on Warm-Water Pond Fish Culture. FAO Fish. Rept. 2(44): 123-134; Biological Abstracts, 49(1): Abst. No. 897. 1968.

10775. Northrop, Robert B. (Dept. Electrical Eng., Univ. Conn., Storrs, Conn.). 1967. ELECTROFISHING. IEEE Trans. Bio. Med. Eng. BME, 14(3): 191-200; Biological Abstracts, 49(1): Abst. No. 908. 1968.

This paper is intended to introduce the reader to the technology of fishing with underwater electric fields, and describes the design of 2 high-power pulse generators used in electrofishing apparatus by the Connecticut State Fish and Game Department. Discussed are problems in the design of electrofishing apparatus, the behavior, and the physiological basis for the behavior of fish in electric fields. (Auth.)

10776. Shabalina, A.A. 1966. THE EFFECT OF COBALT ON PHYSIOLOGICAL CHARACTERISTICS OF FISH. (Deistvie mikroelementa kobal'ta na fiziologicheskie pokazateli ryb). In: Report Summaries of the All-Union Conference on the Ecology and Physiology of Fishes, 1966. Moscow. 43-45. From: Ref. Zh., Biol., 1967, No. 2I96. (Translation); Biological Abstracts, 49(1): Abst. No. 916. 1968.

Cobalt chloride was added to the food of trout, Atlantic salmon and carp. An increase in Hb concentration, in fat content and in scale alkaline phosphotase activity was recorded, and also a change in respiratory rate and in the upper temperature threshold. Toxic doses (0.1, 1.0 and 10.0 g/kg fish weight) caused heavy bleeding in the gastro-intestinal tract and altered the leucocyte count.

10777. Workman, Gar W., and W.F. Sigler (Wildlife Resour. Dept., Utah State Univ., Logan, Utah). 1966. DISTRIBUTION AND ABUNDANCE OF SMALL FISHES IN THE LITTORAL AREA OF BEAR LAKE, UTAH-IDAHO. Proc. Utah Acad. Sci. Lett., 43(Part 1): 29-42. Illus.; Biological Abstracts, 49(1): Abst. No. 928. 1968.

10778. Enger, Per S., and Rolf Andersen (Inst. Physiol., Univ. Oslo, Oslo, Norway). 1967. AN ELECTROPHYSIOLOGICAL FIELD STUDY OF HEARING IN FISH. Comp. Biochem. Physiol., 22(2): 517-525. Illus.; Biological Abstracts, 49(1): Abst. No. 2285. 1968.

In order to study sound reception in fish in the acoustic far-field (propagated sound waves) saccular microphonic potentials were recorded from codfish (Gadus morhua) and sculpin (Cottus scorpius) using implanted electrodes. The fish was held at distances of up to 10 m from an underwater loudspeaker delivering sinusoidal sound stimuli. The experiments were performed at sea where no reflections other than those naturally occurring from surface and bottom were present. In codfish which possess a swimbladder the microphonic potential amplitude was a function of sound pressure only for distances of 0.7 m and more (smaller distances not tested) for frequencies above 200 c/s. For 200 c/s a small effect of the acoustic near-field was observed. Responses to sound of frequencies up to 800-1000 c/s were recorded. In sculpin which lack a swimbladder the microphonic potential

amplitude was dependent on both sound pressure and distance, but was not recorded at all at distances beyond 1 m. The swimbladder in teleosts is apparently essential for hearing in the acoustic far-field, i.e. for hearing propagated sound waves. The swimbladder will generate far-field, i.e. for hearing propagated sound waves. The swimbladder will generate near-field water displacements around itself, produced by compressions and rarefractions of the propagated sound wave. This local near-field effect can stimulate auditory receptors. (Authors)

10779. Silliman, Ralph P. (Bur. of Commercial Fisheries Biological Laboratory, Seattle, Wash.). 1969. POPULATION MODELS AND TEST POPULATIONS AS RESEARCH TOOLS. BioScience, 19(6): 524-528.

Model populations are constructed of physical or mathematical elements and test populations are groups of organisms in small environments. Both can save scientists time and money, particularly in learning about animal populations under exploitation. Rates of mortality, growth, and recruitment are among the most valuable data predicted from modeling.

10780. Goldberg, Erwin, J.-P. Cuerrier, and J.C. Ward (Dept. Biol. Sci., Northwest. Univ., Evanston, Ill.). 1967. LACTATE DEHYDROGENASE ISOZYMES, VERTEBRAE AND CAECA NUMBERS IN AN ISOLATED, INTERBREEDING POPULATION OF SPLAKE TROUT. Natur. Can., 94(3): 297-304. Illus. (Fr. summ.); Biological Abstracts, 49(2): Abst. No. 5672. 1968.

Distribution of lactate dehydrogenase (LDH) isozymes genotypes was studied with an isolated population of splake trout. LDH genes were evolutively stable. However, this genetic equilibrium does not apply to the total gene pool since determination of pyloric caeca and vertebrae numbers does not show such a stability. (Authors)

10781. Bartsch, A.F., R.J. Callaway, R.A. Wagner, and C.E. Woelke (Pacific Northwest Water Lab., U.S. Dept. of the Interior, Corvallis, Oregon). 1967. TECHNICAL APPROACHES TOWARD EVALUATING ESTUARINE POLLUTION PROBLEM. In: Proceedings of the Conference on Estuarines, Mar. 31 - Apr. 3, 1964, Jekyll Island, Ga. Amer. Ass. Advan. Sci. Publ. 83. 693-700; Biological Abstracts, 49(2): Abst. No. 5988. 1968.

Studies of pulp and paper mill waste pollution require the closely coordinated efforts of oceanographers, biologists, engineers, and others. Studies on the adverse effects of SWL (sulfite waste liquor) and other mill wastes, carried out solely in the laboratory, do not sufficiently simulate field conditions and, therefore, cannot be projected directly to existing conditions in the marine environment. Hence, several "bioassay" techniques are used which vary from direct examination of marine populations and the influence of pollutants on them, and semi-natural bioassays with maturing oysters, to laboratory bioassays with oyster larvae to test water collected at suspect points. Oceanographic studies have traced the distribution and persistence of mill wastes. They also show that the wastes occur at points where oysters and juvenile salmon are of major concern. Although still incomplete, the bioassays with growth stages of salmon and oysters cast doubts on suitability of habitat near the waste sources. (Authors)

10782. Andrievskaya, L.D. (Kamchatka Br. Pacific Res. Inst. Fish. Oceanogr., Petropavlovsk-Kamchatskii, USSR). 1966. FOOD RELATIONS OF PACIFIC SALMON IN THE SEA. (Pishchevye vzaimootnosheniya tikhookeanskikh lososei v more). Vop. Ikhtiol., 6(1): 84-90; Biological Abstracts, 49(2): Abst. No. 6044. 1968.

The degree of food similarity was highest between the pink and sockeye salmon over the entire migration route from places of wintering to the mouths of rivers. The food of the pink and chum salmon and of the sockeye and chum was less similar. Changes in the character of the food relations of the pink, sockeye, and chum during even and odd years were rather well defined. During even years the food of these species of salmon is more similar than during odd years. The degree of change of the composition of the food of the pink, sockeye, and chum salmons was

different during years of a large pink population. The composition of the food of the pink changed from spring to summer by 30%, of the sockeye by 57%, and of the chum by 84%. The composition of the food of these fishes changed in the same relationship from even to odd years. Thus, of the three salmon species, the chum salmon has the highest degree of food variability. This apparently explains such marked variations of the food similarity of the chum salmon with the other species of salmon during even and odd years. A decrease of the food similarity of the chum salmon during odd years is a consequence of aggravation of the food competition and a changeover to less favored foods. Consequently, expansion of the food spectrum of the humpback, sockeye, and chum salmons during odd years and the partial or complete changeover to alternative foods are a sign of unfavorable conditions of food availability for these fishes, which is confirmed by a decrease in their rate of growth and maturation during years of a high population. --J. Slep.

10783. Coche, A. G. (Inland Fish. Branch, FAO, Rome, Italy). 1967. FISH CULTURE IN RICE FIELDS — A WORLD-WIDE SYNTHESIS. Hydrobiologia, 30(1): 1-44. (Fr. summ.); Biological Abstracts, 49(2): Abst. No. 6050. 1968.

Fish culture in rice fields is an almost ideal method of land use, combining the production of both vegetable and animal proteins. Its development can make an important contribution to the future world food supply. There are two main types of exploitation. In the captural system wild fish are admitted in the field with irrigation water. In the cultural systems, chosen fish species are deliberately stocked and raised either together with the rice or in rotation with it, the field them becoming a shallow fish pond. (From auth. summ.)

10784. Herrington, Roscoe B., and Donald K. Dunham (Intermt. Forest and Range Exp. Sta., Forest Serv., Ogden, Utah). 1967. A TECHNIQUE FOR SAMPLING GENERAL FISH HABITAT CHARACTERISTICS OF STREAMS. U. S. Forest Serv. Res. Pap. Int. 41. 1-12. Illus. Maps; Biological Abstracts, 49(2): Abst. No. 6057. 1968.

This article describes results of a line transect technique used to estimate selected fish habitat characteristics of three streams in northeastern Utah. Procedures for using technique are described fully. Statistical analyses of the precision of results are given along with suggested modifications of the technique for future use. (Authors)

10785. Kato, Teiichi. 1966. STUDIES ON THE TECHNIQUES OF SALMON- AND TROUT-CULTURING. III. GROWTH AND SURVIVAL RATE OF Salvelinus pluvius, Salvelinus fontinalis fontinalis AND THE HYBRID, Salvelinus pluvius ♀ X Salvelinus fontinalis fontinalis ♂. Freshwater Fish. Res. Lab. Bull., 16(1): 59-64. Illus.; Biological Abstracts, 49(2): Abst. No. 6061. 1968.

In order to determine the suitability of the Japanese char (Salvelinus pluvius Hilgendorf)), the brook trout (Salvelinus fontinalis (Mitchill)) and the hybrid (Salvelinus pluvius ♀ x Salvelinus fontinalis fontinalis ♂) for pond culture, the growth and survival rates were examined from 6 months after fertilization until they attained 2 years of age at 9° C. By observing them for 25 months, the best growth was found in S. fontinalis fontinalis weighing about 266 g followed by 254 g hybrids and 144 g S. pluvius. On the other hand, the survival rate of the hybrids was the highest (about 88%), while that of S. pluvius was next (about 75%) and that of S. fontinalis fontinalis was the lowest. All the males and females of S. fontinalis fontinalis and of hybrids came to maturity within 2 years of age, but nearly 37% of S. pluvius did not mature in the same age. Eggs and spermatozoa obtained from the hybrids normally formed zygotes showing further development. The average number of eggs obtained from one female of 2-year age was 758 in S. fontinalis fontinalis, 458 in S. pluvius and 939 in the hybrids. (Auth.)

10786. Wolf, Ken and M. C. Quimby (Bur. of Sport Fisheries and Wildlife, Eastern Fish Disease Lab., Kearneysville, W. Va.). 1967. LOW-TEMPERATURE INCUBATION USING A WATER SUPPLY. Applied Microbiology, 15(6): 1501

The culture of poikilothermic vertebrate cells using existing low-temperature water supply.

10787. Straskraba, Milan, Jiri Chiar, Stanislav Frank, and Vaclav Hruska (Hydrobiol. Lab., Czech. Acad. Sci., Prague, Czech.). 1966. CONTRIBUTION TO THE PROBLEM OF FOOD COMPETITION AMONG THE SCULPIN, MINNOW AND BROWN TROUT. J. Anim. Ecol., 35(2): 303-311; Biological Abstracts, 49(2): Abst. No. 6079. 1968.

From an investigation in the trout zone of the Moravka stream, results were obtained showing a differentiation of the niches from which the three most common co-existing species of fish obtained their food. The brown trout takes larger animals that move freely or sit upon the bottom, the minnow feeds on smaller animals inhabiting the bottom surface or plants, and the sculpin obtains its food from under stones and among gravel. There was thus little evidence of competition for food among these species. This is contrary to the conclusion generally accepted in the literature from data which, in most instances, have been too limited to be conclusive. (Authors)

10788. MacDonald, D.R. (Can. Dept. Forest. and Rural Develop., Forest Res. Lab., Fredericton, N.B., Canada). 1967. FOREST PROTECTION AGAINST SPRUCE BUDWORM IN NEW BRUNSWICK. In: Background papers prepared for the National Conference on pollution and our environment, Vol. 2, Oct. 31 - Nov. 4, 1966, Montreal, Que., Can., Canadian Council of Resource Ministers: Montreal, Que., Can. B17-2-1. Maps; Biological Abstracts, 49(2): Abst. No. 10390. 1968.

An extensive aerial spraying program against the spruce budworm has been conducted in New Brunswick since 1952 to prevent widespread tree mortality. Over nine million acres have been sprayed one or more times and over 5700 tons of DDT have been used in the program. The outbreak in the northern part of the province collapsed in 1958 and budworm populations in that area have remained at an endemic level since then, but it has continued and expanded in the central region to the present time. Tree mortality in unsprayed check areas in northern New Brunswick exceeded 65% but most of the forest in the sprayed areas has been kept alive and in an operable condition, and the wood-using industries have been able to expand in spite of the current outbreak. Although the spraying program has been successful in protecting the forest, it has had certain unfortunate side-effects. The youngest age-classes of Atlantic salmon suffered severe mortality until the dosage of DDT was reduced and Phosphamidon, an insecticide less toxic to fish, was used along the banks of salmon-producing streams. The economic issues and the extent of the New Brunswick spray program are reviewed in this paper. Some of the biological interactions in the ecosystem associated with both spruce budworm outbreaks and with the extensive spraying of pesticides and application techniques is also reviewed and guidelines for other large-scale control operations are offered. (Auth.)

10789. Meade, Thomas G. (Sam Houston State Coll., Huntsville, Texas). 1967. LIFE HISTORY STUDIES ON Cardicola klamathensis (Wales, 1958) Meade and Pratt, 1965 (TREMATODA: SANGUINICOLIDAE). Proc. Helminthol. Soc. Wash., 34(2): 210-212. Illus.; Biological Abstracts, 49(2): Abst. No. 10488. 1968.

Larval stages of Cardicola klamathensis (Wales 1958) Meade and Pratt, 1965, were obtained from snails collected from Klamath Fish Hatchery, Oregon, and the adult fluke recovered from experimental infections of Lahontan cutthroat trout fingerlings, Salmo clarkii Richardson. From a lot of 10 fish exposed to cercariae, three survived, two for 6 weeks and one for 9 weeks. Immature flukes were removed from all parts of the blood circulatory system; mature forms from the efferent renal vein only. In addition to life history studies, two larval stages are redescribed. Sporocysts were located in the host snail, Flumenicola seminalis Hinds. Cercariae were furcocercous, brevifurcate, and apharyngeate, possessed a fin along the dorsal body surface, and anteriorly displayed an apical papilla with eight rows of spines. Eight penetration glands, a small contractile excretory bladder, and a flame cell formula of 2 [2 + 2] are described. Arrowhead-shaped furcal tips were uniformly present. (Auth.)

10790. Price, Charles E. (N. Tex. State Univ., Dept. Biol., Denton, Texas). 1967. A REVISED DEFINITION OF THE MONOGENETIC TREMATODE GENUS Dactylogyrus, WITH DESCRIPTIONS OF FOUR NEW SPECIES. Proc. Helminthol. Soc. Wash., 34(2): 117-124. Illus.; Biological Abstracts, 49(2): Abst. No. 10492. 1968.

A short history of research on North American Dactylogyrus is recounted. Various taxonomic aspects of the genus are discussed and a revised generic diagnosis is proposed. Four new species of Dactylogyrus are described: D. centrarchidi from Lepomis auritus (L.); D. georgiensis and D. katherineae from Campostoma anomalum (Rafinesque), and D. seamsteri from Phenacobius mirabilis (Girard). The possibility of D. centratchidi being a case of accidental parasitism is briefly discussed. These new forms bring to 60 the total number of Dactylogyrus species reported from North America. (Auth.)

10791. Haw, Frank, Henry O. Wendler, and Gene Deschamps (State Wash. Dept. Fish., Seattle, Wash.). 1967. DEVELOPMENT OF WASHINGTON STATE SALMON SPORT FISHERY THROUGH 1964. Washington Dept. Fish. Res. Bull., 7. 1-192. Illus. Maps; Biological Abstracts, 49(3): Abst. No. 10947. 1968.

10792. Moller, Dag (Inst. Mar. Res., Bergen, Norway). 1966. POLYMORPHISM OF SERUM TRANSFERRIN IN COD. Fiskeridir Skr Ser Havunders, 14(2): 51-60. Illus.; Biological Abstracts, 49(3): Abst. No. 11119. 1968.

Sera from 682 cod from six different localities along the Norwegian coast and in the Barents Sea were investigated by starch/agar gel electrophoresis. Eleven different patterns composed of five molecular types were found. By autoradiography it was demonstrated that four of them are Fe binding proteins. The distribution of the observed transferrin patterns were in agreement with distributions expected according to the Hardy-Weinberg formula, implying that the bands have their origin in five codominant alleles. (Auth.)

10793. Geldiay, Remzi (Dept. Zool., Univ. Ege, Imzir, Turk.). 1962. UPTAKE AND DISTRIBUTION OF THE RADIOACTIVE ISOTOPES Zn^{65} AND Co^{60} THROUGH AQUATIC FOOD CHAINS [Chironomus plumosus, Salmo gairdneri]. (Radyoaktif Zn^{65} Ve Co^{60} Izotoplarinin Sudaki gida zinciri Yolu ile Alinmasi ve Dagilisi Hakkinda Arastirmalar). Ege Univ. Fac. Sci. Sci. Rep. 4. 3-23. Illus. (Turk. summ.); Biological Abstracts, 49(3): Abst. No. 11389. 1968.

10794. Stratton, Frank E., and Perry L. McCarty (San Diego State Coll., San Diego, Calif.). 1967. PREDICTION OF NITRIFICATION EFFECTS ON THE DISSOLVED OXYGEN BALANCE OF STREAMS. Environ. Sci. Technol., 1(5): 405-410. Illus.; Biological Abstracts, 49(3): Abst. No. 11393. 1968.

The biochemical oxidation of inorganic reduced nitrogen compounds has only recently been recognized as a potentially significant factor in the oxygen balance of streams and estuaries. The oxygen requirement is potentially significant even when only small quantities of ammonia nitrogen are present. The rate of the biochemical oxidation process is a function of environmental conditions and initial concentration of nitrifying bacteria, and must be evaluated in each water under consideration if an accurate prediction of the rate of nitrification is to be made. (Authors)

10795. Ketchum, B.H. (Woods Hole Oceanogr. Inst., Woods Hole, Mass.). 1967. MAN'S RESOURCES IN THE MARINE ENVIRONMENT. In: Pollution and marine ecology: Proceedings of the conference on the status of knowledge, critical research needs, and potential research facilities relating to ecology and pollution problems in the marine environment, Mar. 24-26, 1966, Galveston, Texas, Interscience Publishers, John Wiley and Sons: New York, London, and Sydney. 1-11. Illus.; Biological Abstracts, 49(3): Abst. No. 11410. 1968.

10796. Bagenal, T.B. (Ferry House, Ambleside, Westmorland, England). 1967. A METHOD OF MARKING FISH EGGS AND LARVAE [Salmo trutta]. Nature, 214(5083): 113; Biological Abstracts, 49(3): Abst. No. 11442. 1968.

The method is based on two observations; first that sudan black can be used to dye adult living carp, and second, that in trout the fat soluble carotenoids apparently pass unchanged from a female parent trout into the egg and from there into the young fish. These observations suggest that if a fat soluble substance is fed or injected into an adult female parent fish it may pass into the egg and young fish in detectable quantities. (From auth.)

10797. Bodrova, N.V., and B.V. Krayukhin. 1965. THE LATERAL LINE OF FISHES AS AN APPARATUS FOR THE PERCEPTION OF AN ELECTRIC FIELD. (Bokovaya liniya ryb kak apparat vospriyatiya elektricheskogo polya). In: Bionics. Nauka: Moscow. 264-269. From: Ref. Zh., Biol., 1966, No. 7I22. (Translation); Biological Abstracts, 49(3): Abst. No. 11444. 1968.

Sensitivity to an electric current varies among fishes: in the skate it is half as great as in bass; in the zander it is half, and in the burbot one-third as great as in pike. Among 13 spp. of marine fishes, young mullet exhibit the highest sensitivity to an electric current. The role of body-surface receptors in the perception of an electric current was evaluated after injecting the body surface with novocaine and cutting the lateral nerve. After injection of anesthesia, the sensitivity of carp and dwarf sheatfish declined by 25-50%. In pike, zander, bream, burbot and tench normal response was achieved by increasing the current from 10% (burbot) to 65% (pike). After anesthesia species variation in sensitivity to an electric current became negligible. The fishes' response to an electric current decreased after their lateral nerves were cut. To evoke normal response, the current was increased: in pike on the day of the neurotomy, by 35-40%, during the subsequent 8 days by 25-28%, and during the next 12-14 days by 15-20%; in bream on the day of the neurotomy, 25-30%, during the next 4 days by 12-20%, and during the subsequent 12-14 days by 12-15%. The current affects the nerve centers directly.

10798. Kiseleva, V.A. 1966. FEEDING RELATIONSHIPS OF FISHES OF THE UST-KAMENOGORSK RESERVOIR. (Pishchevye vzaimootnosheniya ryb v Ust'-Kamenogorskom vodokhranilishche). In: Biological bases of Central Asian and Kazakhstan fisheries. Nauka: Alma-Ata. 304-306. From: Ref. Zh., Biol., 1967, No. 3I46. (Translation); Biological Abstracts, 49(3): Abst. No. 11462. 1968.

The feeding of roach, ide, bream, perch, ruff and sturgeon is characterized in detail. It is noted that during the first stage of the reservoir's existence, 1956-1960, benthos was underexploited; and named species, the abundance of which was low, fed principally on chironomid larvae, (biomass 14.2 g/m^2). As the fish increased in number owing to the lack of a steady fishery, the biomass of larvae dropped (to 3-7.5 g/m^2) and the diets of the fish became delimited: the sturgeon started to feed on oligochaetes and macrophytes; roach and ide, on molluscs; ruff and ide, on chironomids. To maintain the abundance of commercial fishes, the removal of roach and ruff should be intensified.

10799. Levanidov, V. Ya. (Amur Br. Pacific Res. Inst. Fish. Oceanogr., Khabarovsk, USSR). 1966. INCUBATION OF THE EGGS OF PACIFIC SALMONS UNDER FIELD CONDITIONS. (Opyt inkubatsii ikry tikhookeanskikh lobosei v polevykh usloviyakh). Vop. Ikhtiol., 6(1): 71-76. Illus.; Biological Abstracts, 49(3): Abst. No. 11465. 1968.

Incubation of the eggs of Pacific salmons occurred rather successfully in "artificial nests" with forced circulation placed above and below a dam. It is recommended that at a head of 20 cm and a discharge pipe with a diameter of 1.8 cm, 10-15,000 eggs of chum or humpback salmon can be loaded into the device and 20-25,000 eggs at a discharge tube diameter of 2.5 cm. If the permeability coefficient is high, the discharge of water in the apparatus is proportional to the cross section of the discharge tube and to the square root of the head index. If it is low, surface waters are sucked into the device. The creation of hydrostatic pressure increases the flow in the bottom soil below the dam; here favorable conditions are created for supporting the salmon larvae and incubation of the eggs. The device can be installed in the ground both above and below the dam. --J. Slep.

10800. Salo, Ernest O. (Fish. Res. Inst., Coll. Fisheries, Univ. Wash., Seattle, Wash.). 1967. STUDY OF THE EFFECTS OF LOGGING ON PINK SALMON IN ALASKA [Oncorhynchus gorbuscha]. In: Proceedings of the Society of American Foresters Meeting: Resources, foresters, and policies for progress, Sept. 12-15, 1966, Seattle, Wash., Society of American Foresters: Washington, D.C. 59-62; Biological Abstracts, 49(3): Abst. No. 11476. 1968.

10801. Sheridan, W.L., S. T. Olson, and T.C. Hoffman (U.S. Forest Service, and Fishery Biol., Juneau, Alaska). 1967. MONITORING CERTAIN LAND USE EFFECTS ON SALMON SPAWNING ENVIRONMENT. In: Proceedings of the Society of American Foresters Meeting: Resources, foresters, and policies for progress, Sept. 12-15, 1966. Seattle, Wash., Society of American Foresters: Washington, D.C. 49-52. Illus.; Biological Abstracts, 49(3): Abst. No. 11478. 1968.

Because of possible effects of land use on salmon spawning environment in Alaska, a monitoring technique has been developed by the Forest Service in cooperation with the Alaska Department of Fish and Game. The general objective of the monitoring system is to detect changes in the spawning environment that may adversely affect salmon production. Characteristics being monitored in three streams are as follows: Composition of streambed spawning areas. Streamflow and water temperature. Stream channel configuration and amount and kind of debris in stream channel. Soil types in the watershed. Production of salmon fry. Adult salmon escapement. If harmful changes in the salmon spawning environment do occur, remedial measures can be undertaken. On the other hand, practices which may enhance the habitat can be explained. (Authors)

10802. Skul'skii, I.A., I.V. Burovina, and V.G. Leont'ev (Inst. Evol. Physiol. Ciochem., Acad. Sci. USSR, Leningrad, USSR). 1967. PECULIARITIES IN DISTRIBUTION OF SODIUM, POTASSIUM, RUBIDIUM AND CAESIUM IN FRESH-WATER, MIGRATING, AND MARINE FISHES. (Osobennosti raspredeleniya natriya, kaliya, rubidiya i treziya v organizme presnovodnykh, prokhodnhkh i morskikh ryb). Zh. Evol. Biokhim. Fiziol., 3(1): 16-24. (Engl. Summ.); Biological Abstracts, 49(3): Abst. No. 11480. 1968.

Natural concentrations of the alkaline group elements in the organism of the Pacific salmon Oncorhynchus nerka as well as in the Salvelinus malma, Melanogrammus aeglefinus, and Gadus morhua macrocephalus Tilesius were estimated. Coefficients of the distribution of macroelements (Na and K) and microelements (Rb and Cs) between the environment and the inner medium are given together with those between the inner medium and some tissues of the fishes. Experimental data are discussed in relation to potassium uptake and the ionic selectivity of structures through which a loss of potassium from the organism takes place. For all the species studied coefficients of distribution of Na, K, Rb and Cs between the blood serum and tissues follow a sequence characteristic of the given type of tissue as follows: muscles: K > Rb > Cs > Na; liver: Rb > K > Cs > Na; brain: K > Cs > Rb > Na. (Authors)

10803. Caillouet, Charles W., Jr. (Dept. Zool., Iowa State Univ., Ames, Iowa). 1967. BLOOD LACTIC ACID CONCENTRATION IN BLACK BULLHEADS, Ictalurus melas, AFTER TRANSPORTATION AND FORCED EXERCISE. Iowa State J. Sci., 42(1): 1-7. Illus.; Biological Abstracts, 49(3): Abst. No. 11883. 1968.

In March 1961, black bullheads were transported 2.5 hours in a nonaerated live-tank with about 0.4 lb of fish/gal. of water. The fish were then transferred to another 60-gal. tank containing aerated water at 20° C in the laboratory. Blood lactic acid concentration decreased from an average of 18.5 mg/100 ml of whole blood at 0.8-1.4 hours after transportation to 9.2 mg/100 ml at 2.8-3.4 hours. There were no further significant changes in lactic acid concentration through 34 hours. Bullheads starved for 52 days were subjected to 17 minutes of forced exercise. The mean blood lactic acid concentration of unexercised fish was 5.5 mg/100 ml and that of exercised fish increased significantly to 42.3 mg/100 ml 0.0-0.6 hour after exercise. By 4.2-4.9 hours after exercise the mean blood lactic acid concentration had decreased to near the unexercised level. (Auth.)

10804. Birkhead, William S. (Dept. Zool., Univ. Texas, Austin, Texas). 1967. THE COMPARATIVE TOXICITY OF STINGS OF THE ICTALURID CATFISH GENERA Ictalurus AND Schilbeodes. Comp. Biochem. Physiol., 22(1): 101-111. Illus.; Biological Abstracts, 49(3): Abst. No. 13265. 1968.

Extracts prepared from the stings and caudal fins of 6 species of Ictalurid catfishes were injected into Gambusia affinis. Extracts from the stings of Schilbeodes exilis and Ictalurus melas were more toxic than those from Ictalurus natalis or Schilbeodes nocturnus. Sting extracts from Ictalurus punctatus and Schilbeodes leptacanthus produced little or no effect in the injected fish. Venom cells may be present in the caudal fins of some catfish species. Attempts to explain the toxicity of the sting of a particular species of catfish in terms of the gross anatomy of its venom apparatus appear tenuous. Interspecific differences in the toxicity of the sting have probably developed in response to environmental selection. (Auth.)

10805. Roehm, J. N., D. J. Lee, and R. O. Sinnhuber (Dept. Food Sci., Technol., Oregon State Univ., Corvallis, Oreg.). 1967. ACCUMULATION AND ELIMINATION OF DIETARY GOSSYPOL IN THE ORGANS OF RAINBOW TROUT. J. Nutr., 92(4): 425-428; Biological Abstracts, 49(3): Abst. No. 13393. 1968.

A study was made to determine the pattern of accumulation and elimination of dietary gossypol from various organs of rainbow trout. Young fingerling trout were fed purified diets containing gossypol at levels of 250 and 1000 ppm. Fish fed 1000 ppm gossypol for 18 months accumulated large amounts of gossypol in their tissue, with the highest concentration being in the liver and the lowest in the muscle tissue. After the fish had received a gossypol-free recovery diet for 10 weeks, these tissue levels were only partially depleted, with the free gossypol levels being lowered much more than the bound. The bound gossypol content of the liver was not significantly reduced over this 10-week period. Fish raised with a gossypol-free control diet for 9 months and then fed 1000 ppm dietary gossypol for 2 months accumulated much lower levels of free gossypol in their organs, but levels of bound gossypol approached those of fish fed gossypol for 18 months. Fish fed 250 ppm dietary gossypol for 12 months accumulated lower concentrations of gossypol in their organs. In all cases, the liver accumulated the highest concentration of gossypol. (Authors)

10806. Gilbert, Carter R. (Florida State Mus., Univ. Fla., Gainesville, Fla.). 1967. A REVISION OF THE HAMMERHEAD SHARKS (FAMILY SPHYRNIDAE). U. S. Nat. Mus. Proc., 119(3539): 1-88. Illus. Map; Biological Abstracts, 49(3): Abst. No. 16042. 1968.

The family contains one genus (Sphyrna), containing the following subgenera and spp.: Eusphyra, with a single sp. (S. blochii); Sphyrna, with 4 spp. (S. mokarran, S. zygaena, S. lewini, and S. couardi); and Platysqualus, with 4 spp. (S. tiburo, S. media, S. corona, and S. tudes). Sphyrna tiburo is, in turn, considered to have two sspp.: tiburo, in the western Atlantic; and vespertina, in the eastern Pacific. The subgenus Eusphyra is confined to the Indo-Pacific area. The subgenus Sphyrna contains all the large and dangerous forms; three of these have world-wide distributions, while S. couardi apparently is confined to the coast of west Africa. Platysqualus is almost entirely restricted to the Western Hemisphere, S. tudes having been recorded from the western Mediterranean. In addition to those conventional taxonomic characters previously used in shark taxonomy, the morphology of the chondrocrania and the patterns of the Ampullae of Lorenzini (on the ventral surface of the head) were found to be unique for each sp. The number and nature of the vertebrae were also found to be useful. The spp. are described in detail, primary synonymies are given and all spp. are illustrated. A taxonomic key is presented for identification. (Auth.)

10807. Department of Fisheries, FAO of the UN, Rome, Italy. 1968. THE ROLE OF FAO IN THE DEVELOPMENT OF INLAND FISHERY RESOURCES. FAO Fisheries Technical Paper No. 81. 6 p.

10808. Hayashi, Koichiro, Nobuo Nishioka, Kazuhiko Nishide, and Tokiro Kamata. 1965. STUDIES ON THE VIBRIO-DISEASE OF RAINBOW TROUT (Salmo gairdneri irideus). III. THERAPEUTIC EFFECT OF TM-5 AND PANAZON. Prefect. Univ. Mie Fac. Fish. J., 6(3): 286-289. Illus. (In Jap. with Engl. summ.); Biological Abstracts, 49(4): Abst. No. 17047. 1968.

Therapeutic or prophylactic effects of TM-5 and Tizone-20 upon the Vibrio disease of rainbow trout were studied. Increase in the resistance of the fish against the artificial Vibrio infection was observed by the use of diet containing TM-5, or Tizone-20. Although addition of a large amount of antibiotics (TM-5, Tizone-20, or Furazolidone) to the diet did not yield any appreciable difference between control and test groups for 2 months, another weeks dosage of the antibiotics made the fish muscle alter its color to pinkish orange. (Authors)

10809. Pinskii, F. Ya. 1965. FOOD AND DEGREE OF FOOD UTILIZATION IN REARING SALMON FINGERLINGS IN PONDS. (Pitanie i stepen' ispol'zovaniya kormovoi bazy pri vyrashchivanii segoletkov losoya v prudakh). Tr Vseros Nauch-Issled Inst Prudovogo Rybn Khoz 13. 197-206. From: Ref. Zh., Biol., 1966, No. 3I87. (Translation); Biological Abstracts, 49(4): Abst. No. 17072. 1968.

The work was carried out from May to Sept. 1959 and 1960, at the Tome fish hatchery, Latvian SSR, in a pond 0.98 ha in area and from 0.5 to 2.5 m deep. Aquatic vegetation covered 10-20% of the pond area. Species composition of zooplankton and zoobenthos: 25 spp. of rotifers, 15 of cladocerans, 7 of copepods, 37 of chironomids, caddisflies, and others. The food spectrum of salmon fingerlings is varied. The most important role is played by cladocerans (Bosmina, Alona, Chydorus), copepods (Cyclops strenuus), the chironomids Crictopus sylvestris, Psectrocladius psilopterus, Tanytarsus mancus, caddis and mayfly larvae, as well as water-lice and oligochaetes. The diet varies as the fish grows. Planktonic organisms predominate at the beginning of the rearing period. Larval chironomids are an important component of the salmon's food throughout the entire rearing period particularly in June and July, their frequency of occurrence decreasing in August and September. The water-louse is one of the preferred foods in August and September. The frequency of occurrence of oligochaetes is low, and they probably form an obligatory and secondary food. Feeding selectivity varies as the fingerlings grow, and also in the course of a day. Larval chironomids and cladocerans (Bosmina longirostris) are the most preferred foods at the beginning of the growing period, while the larvae of caddisflies, mayflies and geleids are the preferred foods at the end of the growing period. The ninespine stickleback competes with the salmon for food, particularly at the beginning of the growing period.

10810. Jorgensen, Spike, and Richard Wickwar (Black Hills State Coll., Spearfish, S.D.). 1965. A STUDY OF BLACK HILLS TROUT LIVER DEGENERATION. Proc. S. Dak. Acad. Sci., 44. 225-226; Biological Abstracts, 49(4): Abst. No. 17594. 1968.

The component reduction and the increase of fat in the diet did not cause fatty infiltration or excess glycogen storage in trout up to the ages of those studied. Nor was there synchronous excess vacuolation or necrosis of the tissue. (This destroys the development of a standard slide series). The x-29 diet fish were larger and grew faster than those on proven control diets and there may have been several contributing factors. Excess choline, known to be a growth inhibitor in plants, could have retarded fish growth in the control diet. Vitamin A content may have been too high in the control diet and A-hypervitaminosis may have been involved. (Authors)

10811. Hoffman, Glenn L. (Eastern Fish Disease Lab., Bur. of Sport Fisheries and Wildlife, Kearneysville, W.Va.). 1967. AN UNUSUAL CASE OF FISH DISEASE CAUSED BY Ophryoglena SP. (PROTOZOA: HYMENOSTOMATIDA). [In Micropterus salmoides, Lepomis macrochirus, Semotilus spp., Cottus bairdi]. Bull. Wildlife Dis. Ass., 3(3): 111-112. Illus.; Biological Abstracts, 49(4): Abst. No. 21471. 1968.

10812. Wellborn, Thomas L., Jr. (U.S. Dept. of the Interior, Auburn Univ., Auburn, Ala.). 1967. Trichodina (CILIATA: URECOLARIIDAE) OF FRESHWATER FISHES OF THE SOUTHEASTERN UNITED STATES. J. Protozool., 14(3): 399-412. Illus.; Biological Abstracts, 49(4): Abst. No. 21540. 1968.

Eight new species of Trichodina are described from freshwater fishes of the southeastern U.S.: T. davisi from Roccus saxatilus (Walbaum), T. funduli from Fundulus notti (Agassiz), T. globosa from Etheostoma radiosum (Hubbs and Black), T. hoffmani from Etheostoma edwini (Hubbs and Cannon), T. hypsilepis from Notropis hypsilepis Suttkus and Raney, T. microdenticula from Dorosoma petenense (Gunther), T. noturi from Noturus teptacanthus Jordan, and T. salmincola from Salmo gairdneri Richardson. Nine species of Trichodina are redescribed: T. californica, T. discoidea, T. fultoni, T. pediculus, T. platyformis, T. reticulata, T. sp. (?T. nigra), T. tumefaciens, and T. vallata. The name T. pediculus is re-erected for the form that occurs on largemouth bass. Host fish were collected from 36 geographic locations in 10 states (Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, South Carolina, and Tennessee). A total of 939 fish of 46 species was examined for trichodinid parasites. Two methods of impregnating formalin preserved specimens of Trichodina with silver are discussed. A key to the species of Trichodina reported from North American freshwater fishes is given. (Auth.)

10813. Beverton, R.J.H., and D.S. Tungate (Nat. Environ. Res. Counc., State House, London, England). 1967. A MULTI-PURPOSE PLANKTON SAMPLER. J. Cons. Cons. Perma. Int. Explor. Mer, 31(2): 145-157. Illus.; Biological Abstracts, 49(5): Abst. No. 22310. 1968.

The design, operation and working characteristics of a multi-purpose sampler which has been developed at the Lowestoft Laboratory and used extensively during the last four years is described. It was designed in the first instance for quantitative research into the biology of the North Sea plaice, the requirement being for a device that would sample simultaneously and in the same way the abundance not only of plaice eggs and larvae, but also that of their planktonic competitors and predators and, in particular, their food organisms. The sampler is 2.44 m in length and 76 cm in diameter. It is fitted with interchangeable conical nylon nets which vary in mesh size from 0.560-0.270 mm. The filtration efficiency of the sampler ranges from 80.2% to 95.1%, depending on the nose-cone aperture and the net used. The sampler is normally operated at a speed of 5 knots, but it has been towed over the speed range 2.5 to 8 knots and remained stable. (Authors)

10814. Gover, W.C. 1967. MY RANGE USE AFFECTS SALMON AND STEELHEAD PRODUCTION. J. Range Manage., 20(4): 263-265. Illus.; Biological Abstracts, 49(5): Abst. No. 22380. 1968.

The Gover Ranch carries out a program of streambank manipulation and shore protection that maintains suitable spawning grounds for king salmon and steelhead. Estimated values are very high. (Auth.)

10815. Lea, Robert N. (Mus. Vertebrate Zool., Univ. Calif., Berkeley, Calif.). 1967. OBSERVATIONS ON THE FOOD HABITS OF ADULT BLACK CRAPPIE IN A CALIFORNIA LAKE [Pomoxis nigromaculatus, Daphnia sp., Diaptomus, Pelopia sp; Hyalella azteca]. Ichthyol. Aquarium J., 39(2): 93-94. Illus.; Biological Abstracts, 49(5): Abst. No. 22392. 1968.

10816. Mel'nikov, V.N. (Inst. Fish. Ind., Astrakhan, USSR). 1966. QUANTITATIVE ESTIMATE OF THE EFFECT OF ARTIFICIAL LIGHT ON FISHES. (Kolichestvennaya otsenka vozdeistviya sveta iskusstvennykh istochnikov na rybu). Biol. Nauk, 9(3): 113-117. Illus.; Biological Abstracts, 49(5): Abst. No. 22398. 1968.

A method is examined investigating the effectiveness of light of a different spectral distribution on the eyes of fishes in order to select light sources for catching fish. The investigations were carried out on the Caspian sprat (Clupeonella delicatula caspia) and the anchovy-like sprat (C. engrauliformis). The effectiveness

of action of a unit of radiant flux on the light-adapted eye of these sprats was somewhat lower at a high color temperature of the light source (above 3500° K), and remained at approximately the same level for sources with a lower color temperature. There was no appreciable change in the effectiveness of action of a unit of radiant flux when the distance to the light source was increased from 0.5 m. In a state of dark adaptation for the anchovy-like sprat the effectiveness of action was approximately the same at various color temperatures of the sources, whereas for the Caspian sprat it dropped somewhat with a decrease of color temperature. The approximately identical effectiveness of the action of a unit of radiant flux from various sources on the fishes at a distance of more than 0.5 m from the source was explained by absorption of invisible radiations by a very thin layer of water. When estimating the effectiveness of the action of radiation on the eyes of fishes close to a source one must take into account the relative spectral sensitivity of the eyes in a state of light adaptation. At the boundary of the zone of action of the light source the problem becomes less defined since the threshold value of illumination at which the fish detects the source varies within wide limits. --J. Slep.

10817. Musselius, V.A., and Yu. A. Strelkov. 1966. DISEASES OF HERBIVOROUS FISHES AND MEASURES FOR THEIR CONTROL. (Bolezni rastitel'noyadnykh ryb i mery bor'by s nimi). In: Cultivation of herbivorous fishes. Nauka: Moscow. 95-104. From: Ref. Zh., Biol., 1966, No. 71195. (Translation); Biological Abstracts, 49(5): Abst. No. 22399. 1968.

Attention is called to the spread of dangerous diseases which were introduced together with herbivorous fishes; botriocephalosis among "white amur" and carps, and synergasilosis among "white amur" and, possibly, silver carp. As regards diseases endemic in the Soviet Union, amurs and grass carp are susceptible to ichthyophthiriasis, chilodonelliasis and trichodiniasis, while silver carp are particularly prone to blackspot disease and lernaeosis. For the control of botriocephalosis the author recommends vermifuge treatment of the fish with kamala in a dose of 100 mg/fingerling/day or 2, or phenothiazene in a dose of 80-100 mg/fish, treatment of pond bottom with calcium hypochlorite, drying and freezing. "Chlorophos" was evaluated on synergasilosis. With ichthyophthiriasis, positive results were obtained by the use of long baths (2 weeks at a temperature of 18-20° C) containing 0.7% NaCl. Baths with 5% NaCl, given for 5 minutes at a temperature of 10-16° C, and ammonia baths (concentration, 1%) given for 0.1 minute, are recommended as prophylactic measures for fingerling "white amur" and carp. A list is given of preparations against parasites of Chinese herbivorous fishes.

10818. Ovchynnyk, M.M. (Mus., Michigan State Univ., East Lansing, Mich.). 1965. ON AGE DETERMINATION WITH SCALES AND BONES OF THE WHITE SUCKER, Catostomus commersoni (Lacepede). Zool. Anz., 175(4/6): 325-345. Illus.; Biological Abstracts, 49(5): Abst. No. 22401. 1968.

Most investigators use the growth marks on scales of the white sucker as the only method to study its age and growth. This study, based upon 7 specimens collected in 1950-1953 from Hemlock Lake and Lost Lake, Michigan, and Big Bay De Noc, Lake Michigan, compares the validity of the use of scales and bones for age determination. The regularity of the number of ridges formed each year (about 10, as reported by Stewart 1926) was not found in the present study. Not all annuli on scales form in spring. Some form in summer, some in autumn, or some may not form until the following year. Thus, there may be years when no annuli are formed. The distances between annuli on the scales is different from those on the bones, especially in the 1 and 2 year and the 6 and 7 year zones. There is a great difference between the number of year marks on scales and the number on bones. The year marks on the bones are much more reliable indicators of age than scales. Examination of all bones of the skeleton of the white sucker showed that the most suitable bones for age determination are: lacrimale, operculum, and frontale, followed by dermethmoid, pectoral fin-ray sections. The differences in the number of marks on the pharyngeal arch and of annuli on the bones was 4 to 6 for all specimens studied. It is possible that the number of these marks corresponds with the number of spawnings, but the matter needs further investigation. (Auth.)

10819. Schaefer, Milner B. (Inst. Mar. Resour., Univ. Calif., La Jolla, Calif.). 1967. FISHERY DYNAMICS AND PRESENT STATUS OF THE YELLOWFIN TUNA POPULATION OF THE EASTERN PACIFIC OCEAN [Thunnus albacares, Thunnus alalunga, Katsuwonus pelamis]. Bull. Inter. Amer. Trop. Comm., 12(3): 89-136. Illus. (In Engl. and Span. summ.); Biological Abstracts, 49(5): Abst. No. 22405. 1968.

From morphometric data, tagging results and reaction of the stock to fishing, it is inferred that the yellowfin tuna of the Eastern Pacific form a distinct population which intermingles little, if at all, with populations to the westward. Excellent statistics of catch and effort, and records of total catch, available since 1934, during rapid growth of the fishery, have made possible application of a generalized mathematical predator-prey model to estimate the effect of fishing on the population, and the average abundance and yield corresponding to different amounts of fishing effort, and also to estimate the rate of fishing mortality per unit of effort. From serial samples of size composition of catches, and from tagging experiments, it has been possible to determine rates of growth and of total mortality. These kinds of information permit application of the catch-per-recruit model of Beverton and Holt. Combination of the results of application of the Beverton and Holt model and of the generalized predator-prey model, leads to inference of the relationship between stock size and recruitment. The form of the relationship is remarkably similar to the theoretical model developed by W. E. Ricker. These studies, based on the data of the near-surface fishery by baitboats and purse seiners, indicate clearly that the increased intensity of fishing has caused diminution of the stocks to the point where they are somewhat "overfished" that is, incapable of supporting the maximum sustainable average harvest. (Auth.)

10820. Noda, Shiroyuki, and Shinko Tachino. 1965. STUDIES ON VARIOUS PHOSPHATASES OF THE FISHES: I. ENZYME MEASUREMENTS. Prefect Univ. Mie J. Fac. Fish., 6(3): 291-301. Illus. (In Jap. with Engl. summ.); Biological Abstracts, 49(5): Abst. No. 22792. 1968.

The properties and optimum assay condition are described of five phosphatases in the tissues from rainbow trout (Salmo gairdnerii irideus), identified as: alkaline phosphatase (Alk Pase), acid phosphatase (Ac Pase), phosphodiesterase (PDEase), glucose-6-phosphophatase (G-6-Pase), and adenosine triphosphatase (ATPase). The method is based on preparation of a crude extract. The effects of variation of pH, time, temperature, substrate concentration, amount of enzyme, grinding, extractive solution, activator and inhibitor were investigated. The quantitative distribution of these enzymes in the adult rainbow trout tissues was determined colorimetrically by measuring the amount of p-nitrophenol (Ac Pase, Alk Pase and PDEase) and inorganic P (G-6-Pase and ATPASE) liberated from the substrate. (Authors)

10821. Barrington, E. J. W., and B. B. Rawdon (Dept. Zool., Univ. Natal, Durban, South Africa). 1967. INFLUENCE OF THYROXINE UPON THE UPTAKE OF S^{35}-LABELLED SULPHATE INTO THE BRANCHIAL ARCH SKELETON OF THE RAINBOW TROUT (Salmo gairdnerii). Gen. Comp. Endocrinol., 9(1): 116-128. Illus.; Biological Abstracts, 49(5): Abst. No. 23572. 1968.

The uptake of S^{35}-labelled sulphate into the chondroitin sulphate of the branchial arches of young rainbow trout has been quantitatively determined by measurement of the radioactivity of skeletal extracts, the location of the isotope having been established by autoradiography. It is shown that the level of total and bound radiosulphate in extracts of the cartilage and the developing bone is significantly increased in fish that have been previously immersed in a 1/500,000 aqueous solution of l-thyroxine [T_4]. It is concluded that exogenous T_4 is able to exert a growth-promoting action upon skeletal tissues in this fish, but it is pointed out that the hormone is not necessarily acting in isolation.

10822. Barnard, J. Laurens and W. Scott Gray (Smithsonian Institution, Wash., D. C.). 1968. INTRODUCTION OF AN AMPHIPOD CRUSTACEAN INTO THE SALTON SEA, CALIFORNIA. Bull. S. Calif. Acad. Sci., 67(4): 219-232.

10823. Wunder, Wilhelm (Untersuchungs. Teichwirtschaft, Zool. Inst., Univ. Nurnberg, West Germany). 1966. THE SKELETON OF THE HUMPBACK SALMON (Oncorhynchus gorbuscha Walb.). (Das skelett des buckellachses (Oncorhynchus gorbuscha Walb.). Z. Morphol. Okol. Tiere, 58(2): 173-181. Illus. (Engl. summ.); Biological Abstracts, 49(5): Abst. No. 23654. 1968.

Radiograms of male specimens of the humpback salmon (Oncorhynchus gorbuscha) were used to discover which variation of the skeleton takes place during the development of the humpback. The vertebrate column was not changed. The dorsal processus spinales (neuralia) and the fish-bones in the region of the humpback (epineuralia and interneuralia) were elongated, thickened and formed the bony support of the humpback. A restitution of the normal state does not occur because the animals die immediately after spawning. (From. auth. summ.)

10824. Josserand, Pierre, Claude Peyraud, and Claude Azais (Fac. Sci., Toulouse, France). 1967. A LABORATORY METHOD FOR ANALYZING THE INFLUENCE OF ACOUSTIC STIMULI ON FISH. (Realization technique d'un dispositif de laboratoire destine a l'analyse de l'influence des stimuli acoustiques chez le poisson). J. Physiol. (Paris), 59(3): 235-238. Illus. (Engl. summ.); Biological Abstracts, 49(5): Abst. No. 23726. 1968.

The technique described is a laboratory method by which one can carry out quantitative studies on the auditory physiology of aquatic animals. Reproducible acoustic stimuli of a determined spectral constitution can be produced. (Authors)

10825. Marasas, W.F.O., E.B. Smalley, P.E. Degurse, J.R. Bamburg, and R.E. Nichols. (Dept. Plant Pathol., Univ. Wisc., Madison, Wisc.). 1967. ACUTE TOXICITY TO RAINBOW TROUT (Salmo gairdnerii) OF A METABOLITE PRODUCED BY THE FUNGUS Fusarium tricinctum. Nature (London), 214(5090): 817-818. Illus.; Biological Abstracts, 49(5): Abst. No. 24215. 1968.

10826. Nishiuchi, Yasuhiro, and Yasushi Hashimoto (Agr. Chem. Inspection Sta., Kodaira, Tokyo, Japan). 1967. TOXICITY OF PESTICIDE INGREDIENTS TO SOME FRESH WATER ORGANISMS. Botyu Kagaku Bull. Inst. Insect Contr., 32(1): 5-11. Illus. (In Jap. with Engl. summ.); Biological Abstracts, 49(5): Abst. No. 24226. 1968.

Toxicities of 76 kinds of pesticide ingredients to 3 kinds of fresh water fishes and 2 kinds of fresh water daphnids were evaluated. The test organisms were Cyprinus carpio Linne, C. auratus Linne, Oryzias latipes (Temminck et Schlegel), Daphnia pulex (de Geer), and Moina macrocopa Straus. In general, organophosphorus compounds are less toxic to fresh water fishes, while these are remarkably toxic to daphnids. Some organophosphorus compounds are toxic to both fishes and daphnids exceptionally. Chlorinated hydrocarbon compounds are remarkably toxic to the fishes, but not so toxic to daphnids. An exception is Thiodan, which is remarkably toxic to both fishes and daphnids. Carbamate insecticides are non-toxic to fishes, but specifically toxic to daphnids. Organomercuric and organotin compounds are remarkably toxic to both fishes and daphnids. Organoarsenic fungicides have a low toxicity to both fishes and daphnids. Organosulfuric and the other synthetized fungicides tested are highly toxic to fishes, but not so toxic to daphnids. Herbicides are generally non-toxic to both fishes and daphnids, but some of them are toxic. Fresh water fishes and daphnids are clearly different in susceptibility to pesticides. It is impossible to presume the susceptibility of the fishes to pesticides from that of daphnids and vice versa. A considerably high correlation is recognized between the susceptibility of Cyprinus carpio and C. auratus, and between Daphnia pulex and Moina macrocopa. Oryzias latipes is selectively susceptible to some kinds of pesticide ingredients. (Authors)

10827. Paterson, Colin G., and William R. Turner (Dept. of Biology, Univ. of Waterloo, Waterloo, Ont., Canada). 1968. THE EFFECT OF AN UNDERWATER EXPLOSION ON THE FISH OF WENTZEL LAKE, ALBERTA. Can. Field Nat., 82(3): 219-220.

10828. Mizelle, John D., and Delane C. Kritsky (Sacramento State Coll., Sacramento, Calif.). 1967. STUDIES ON MONOGENETIC TREMATODES. XXXIII. NEW SPECIES OF Gyrodactylus AND A KEY TO THE NORTH AMERICAN SPECIES. Trans. Amer. Microsc. Soc., 86(4): 390-401. Illus.; Biological Abstracts, 49(5): Abst. No. 26848. 1968.

Five new species of Gyrodactylus are described: G. colemanensis from Salmo gairdneri Richardson, Coleman National Fish Hatchery, Anderson (Shasta Co.) and Navarro River (Mendocino Co.); G. crysoleucas from Notemigonus crysoleucas (Mitchill), Rooney Pond, 17 miles east of Sacramento (Sacramento Co.) (all)California; G. lacustris from Pimephales promelas Rafinesque, Cottonwood Lake, 2 miles north of Butte (McHenry Co.), North Dakota; G. perforatus from Clevelandia ios (Jordan and Gilbert), Bodega Lagoon (Sonoma Co.); and G. variabilis from Notemigonus crysoleucas, Rooney Pond, 17 miles east of Sacramento (Sacramento Co.) (both) California. Gyrodactylus hoffmani Wellborn and Rogers, 1967, is recorded from Pimephales promelas, Cottonwood Lake, 2 miles north of Butte (McHenry Co.), North Dakota. Parasite-host and host-parasite lists, and a key to the North American species of Gyrodactylus are provided. (Authors)

10829. Ballintijn, C.M. (Zool. Lab., Univ. of Groningen, Haren, Netherlands). 1969. FUNCTIONAL ANATOMY AND MOVEMENT CO-ORDINATION OF THE RESPIRATORY PUMP OF THE CARP (Cyprinus carpio L.). J. Exp. Biol., 50(3): 547-567.

An anatomical description of the head skeleton of the carp (Cyprinus carpio) is given. The description is limited to what is relevant for the functioning of the respiratory pumps. An anatomical description of the head muscles of the carp is given. The result of the contraction of most of the head muscles through coupling of skeletal elements spreads farther over the respiratory system than only to the bones to which the muscles are attached directly. It is through this that in the first place all the muscles producing laterad movements, with the exception only of the dilator operculi, influence the volume of both the buccal and opercular cavities, and in the second place that contraction of the hypobranchial muscles not only results in vertical movements of the floor of all the respiratory cavities, but also in laterad movements of their side walls. The hyoid arch plays a central role in the coupling system because it interconnects almost all the other elements. The functional significance of the interaction through couplings is integration of the respiratory movements through which during low-intensity breathing whole muscles can cease to be active and during high-intensity respiration whole muscles can be recruited without seriously affecting the co-ordination of the movements and hence the hydrodynamic efficiency of the pumps. (Auth. summ.)

10830. Ballintijn, C.M. (Zool. Lab., Univ. of Groningen, Haren, Netherlands). 1969. MUSCLE CO-ORDINATION OF THE RESPIRATORY PUMP OF THE CARP (Cyprinus carpio L.). J. Exp. Biol., 50(3): 569-591.

An analysis has been made of the pattern of activity of the muscles of the head of the carp, in relation to respiratory movements and pressures generated in the buccal and opercular cavity, during normal respiration and during coughing. From comparison with the results of analyses carried out on other species of fish it is suggested that the respiratory movements of free-swimming teleosts in general conform to the following principles: the lateral expansions and contractions of the buccal and opercular cavities are always synchronous, but the lowering of the floor of the mouth may be synchronous with, or may precede, the lateral expansion. In the carp the levator operculi muscle, although it inserts on the opercular bone, does not participate in the opercular pump but is the abductor of the lower jaw. (Auth. summ.)

10831. Wolf, Ken (Eastern Fish Disease Lab., Bur. of Sport Fisheries and Wildlife, Kearneysville, W.Va.). 1969. VIRUS DISEASE OF SOCKEYE SALMON. Bureau of Sport Fisheries and Wildlife Fish Disease Leaflet 14. 3 p. (Formerly Fishery Leaflet 454 of July 1958).

10832. Ballintijn, C. M. (Zool. Lab., Univ. of Groningen, Haren, Netherlands). 1969. MOVEMENT PATTERN AND EFFICIENCY OF THE RESPIRATORY PUMP OF THE CARP (Cyprinus carpio L.). J. Exp. Biol., 50(3): 593-613.

A study of the function of the respiratory muscles is made by influencing the respiratory movements artificially (keeping jaw or opercula open or closed) and analysing the compensatory changes in muscle activity. The differential pressure curves during experiments with mouth and opercula open or closed confirm that the buccal and opercular pump are alternately effective. The respiratory efficiency of the pumps, in terms of both constancy of the water flow over the gills and volume output, decreases if the mouth opens before the transition from compression to expansion of the cavities (as is realized in the trout) and increases if it opens later. In the carp lower jaw abduction occurs at the same time as the transition. An electric analogue of the respiratory pumps has been constructed. It confirms the opinion that the respiratory pressure curves of fishes are generated by a double pump with in-phase cavity movements. Further, it demonstrates that the efficiency of the pumps is greater if lower jaw abduction is synchronous with the onset of cavity expansion (carp) than if it is earlier (trout). The efficiency, however, is shown to be maximal if the mouth opens slightly later. (Auth. summ.)

10833. Evans, David H. (Dept. of Biological Sciences, Univ. of Lancaster, Lancaster, England). 1969. STUDIES ON THE PERMEABILITY TO WATER OF SELECTED MARINE, FRESHWATER AND EURYHALINE TELEOSTS. J. Exp. Biol., 50(3): 689-703.

Measurements were made of the flux of tritiated water across various marine, freshwater and euryhaline teleosts. The effects of temperature, body size, species differences, salinity, stress and anaesthetization were studied. The Q_{10} of the flux of water across teleosts is approximately 1.90 and the flux is related to the 0.88 power of the body weight. All of the freshwater species studied were more permeable to water than the marine species. Euryhaline teleosts appear to have about the same permeability as species to which they are most closely related. While the flounder and the yellow eel are more permeable to water in fresh water than in sea water, the silver eel and the brown trout do not change their permeability and the 3-spined stickleback is less permeable to water in fresh water than in sea water. While stress markedly increases the permeability to water of large brown trout, it has no effect on small brown trout and seems to decrease the water permeability of the plaice. Anaesthetization has no effect on the water permeability of the goldfish but markedly increases the permeability to water of the silver eel. The relationship between the flux of water and either the drinking rate in sea water or the urine flow in fresh water is discussed. (Auth. summ.)

10834. Pollock, Robert D. (Columbia Fish. Progr. Office, Bur. of Commercial Fisheries, Portland, Oreg.). 1969. TEHAMA-COLUSA CANAL TO SERVE AS SPAWNING CHANNEL. Progr. Fish Cult., 31(3): 123-130.

Technicians of the Bureau of Reclamation and Fish and Wildlife Service developed plans to use the uppermost part of the Tehama-Colusa Canal as a dual-purpose facility which would transport a maximum flow of 3,150 cubic feet per second, mostly for irrigation, and provide a spawning channel for chinook salmon (Oncorhynchus tshawytscha). Extensive hydraulic research was undertaken to develop a channel section suited to the biological needs of the salmon. Additional research was devoted to solving the anticipated problem of silt deposition in the spawning gravels. This report describes the basic requirements of salmon-spawning channels, the problems arising at the Tehama-Colusa Canal and their solutions, and the various fish facilities involved. (Auth.)

10835. Shrable, John B., O. W. Tiemeier, and C. W. Deyoe (Kansas State Univ., Manhattan, Kan.). 1969. EFFECTS OF TEMPERATURE ON RATE OF DIGESTION BY CHANNEL CATFISH. Progr. Fish Cult., 31(3): 131-138.

Experiments were run at 10.0°, 15.5°, 21.1°, 23.9°, 26.6°, and 29.4° C with age groups II and III channel catfish (Ictalurus punctatus). After acclimation at each temperature, fish were force-fed 3 grams each of pelleted feed and killed at 2-, 4-, 6-, 8-, 10-, 12-, 18-, and 24-hour intervals. Stomach and intestine

contents were removed, dried, and weighed. Statistical analyses indicated that linear effects of temperature and time on the rate of decrease of food from the digestive tracts was significant at the 0.05 level. Interaction between temperature and time were not significant, except for percentage of dry matter still in intestines 24 hours after feeding. Food in the intestines increased to a maximum in 12 hours after feeding, then decreased. Mean percentage of dry matter remaining in digestive tracts during a 24-hour period after feeding was lowest at 26.6° C, and increased progressively at 29.4°, 23.9°, 21.1°, 10.0°, and 15.5° C. Mean percentage of dry matter in stomachs at the 24-hour interval was lowest at 29.4° C; percentages remaining increased progressively at 26.6°, 23.9°, 21.1°, 15.5°, and 10.0° C. In general, there was no significant difference at the 0.05 level in the mean percentages of dry matter in stomachs at 10.0° and 15.5° C, or at 21.1°, 23.9°, 26.6°, and 29.4° C. Digestion was much slower at 10.0° and 15.5° C than at higher temperatures. Digestive tracts maintained at temperatures above 15.5° C were nearly empty 24 hours after feeding. Fish held at 26.6° and 29.4° C were more active than fish at lower temperatures. In an experiment run at 32.2° C, 12 of 30 fish died and survivors were weak and sluggish. (Authors)

10836. Marking, Leif L. (Bur. of Sport Fisheries and Wildlife, Fish Control Lab., La Crosse, Wisc.). 1969. TOXICITY OF RHODAMINE B AND FLUORESCEIN SODIUM TO FISH AND THEIR COMPATIBILITY WITH ANTIMYCIN A. Progr. Fish Cult., 31(3): 139-142.

Rhodamine B and fluorescein sodium, 2 organic dyes used in checking water flow and dispersion, were nontoxic—at practical application rates—to rainbow trout (Salmo gairdneri), channel catfish (Ictalurus punctatus), and bluegills (Lepomis macrochirus). Rhodamine B, the more toxic of these 2 dyes, had 96-hour LC_{50}'s ranging from 217 ppm for rainbow trout to 379 ppm for bluegills and 526 ppm for channel catfish. The 96-hour LC_{50}'s for fluorescein sodium were 1,372, 2,267, and 3,433 ppm for rainbow trout, channel catfish, and bluegills, respectively. Five or 100 ppm of either dye did not appreciably change the toxicity of antimycin A to fish. (Auth.)

10837. Mitchum, Douglas L., and Tom D. Moore (Wyoming Game and Fish Comm., Game and Fish Research Lab., Laramie, Wyo.). 1969. EFFICACY OF DI-N-BUTYL TIN OXIDE ON AN INTESTINAL FLUKE, Crepidostomum farionis, IN GOLDEN TROUT. Progr. Fish Cult., 31(3): 143-148.

Golden trout (Salmo aguabonita) had excessive losses and showed deterioration in production of eggs and sperm when infected with the digenetic trematode Crepidostomum farionis. Infected fish had an average of 21.3 flukes. Di-n-butyl tin oxide was tested as an anthelmintic by force-feeding specific doses in laboratory toxicity and efficacy tests. Toxicity tests on rainbow trout (Salmo gairdneri) indicated the compound was non-toxic at doses ranging to 600 mg/kg of body weight. Efficacy was 100% at total doses of 150, 250, and 350 mg/kg of body weight over a 3-day period. Drug residue was found only in the digestive tract and was confined primarily to the intestine. (Authors)

10838. Cruea, Darrell D., Lafayette L. Eller, and Nancy Priddy (Bur. of Sport Fisheries and Wildlife, Fish-Pesticide Research Lab., Columbia, Mo.). 1969. A NEW STAIN FOR FISH SPERM. Progr. Fish Cult., 31(3): 148.

When compared to other stains, pinacyanol chloride had superior staining characteristics and reproducibility in evaluating fish sperm abnormalities for reproductive soundness. (Authors)

10839. Vanderhorst, Richard, and Sue D. Lewis (Fisheries Research Lab., and Dept. of Zoology, Southern Illinois Univ., Carbondale, Ill.). 1969. POTENTIAL OF SODIUM SULFITE CATALYZED WITH COBALT CHLORIDE IN HARVESTING FISH. Progr. Fish Cult., 31(3): 149-154.

Sodium sulfite, applied at the rate of 22 lb per acre-foot per parts per million of dissolved oxygen and catalyzed with 0.5 gram of cobalt chloride per pound of sulfite, will remove dissolved oxygen from pond water. Fish begin to surface 10

to 15 minutes after application, and at least some species can be readily captured. Tests were made on channel catfish (Ictalurus punctatus), golden shiner (Notemigonus crysoleucas), black bullhead (I. melas), and some centrarchids. The best recoveries were made for channel catfish. Success of the method was limited by the short period in which fish were available for capture. (Authors)

10840. Bender, Michael E. (Dept. of Environmental Health, Univ. of Michigan, Ann Arbor, Mich.). 1969. UPTAKE AND RETENTION OF MALATHION BY THE CARP. Progr. Fish Cult., 31(3): 155-159.

Carp (Cyprinus carpio) were exposed to test concentrations of malathion in 200-liter tanks in which the solutions were renewed daily to maintain levels. The tanks were equipped with an overflow and were flushed with fresh water during the residue retention studies. Ingestion studies were made by feeding the carp malathion in gelatin capsules and placing these fish in the flow unit along with control animals. After 24 hours the malathion-fed fish were sacrificed and their tissue levels were compared with the controls. Tissue levels of malathion were determined by gas chromatography after the various samples had been extracted with hexane. Highest concentrations of malathion occurred in the liver, while flesh, blood, gills, and brain (in that order) showed decreasing concentrations. The uptake rates of malathion from aqueous solutions as a function of time and of increasing aqueous concentration followed sigmoidal relationships. Residue levels in the flesh after a 4-day exposure to 2.5 mg/l were above levels established by the Federal Drug Administration. Uptake from solutions increased until the fourth day, when a pronounced plateau was observed. Retention time for residues was extremely short; 12 hours was the average half-life of a residue. Uptake of malathion via the oral route, as studied, was insignificant. (Auth.)

10841. Meyer, Fred P. (Bur. of Sport Fisheries and Wildlife, Fish Farming Experimental Station, Stuttgart, Ark.). 1969. A POTENTIAL CONTROL FOR LEECHES. Progr. Fish Cult., 31(3): 160-163.

Five species of freshwater leeches were placed in solutions of Baygon®, Baytex®, or Dylox®. Erpobdella punctata, Illinobdella moorei, Piscicola salmositica, Placobdella parasitica, and Theromyzon sp. showed variable susceptibility, but all were killed by concentrations of 0.5 ppm (active) Dylox. Baygon and Baytex were less toxic and concentrations of 1.0 ppm failed to kill several species. (Authors)

10842. Rabe, Fred W., and Robert C. Wissmar (Dept. of Biological Sciences, Univ. of Idaho, Moscow, Ida.). 1969. SOME EFFECTS OF ANTIMYCIN IN AN OLIGOTROPHIC LAKE. Progr. Fish Cult., 31(3): 163.

Antimycin A applied in a subalpine lake accounted for a rapid kill of the cutthroat trout (Salmo clarki) population and a temporary disappearance of microcrustaceans. (Authors)

10843. Thomas, Allan E. (Bur. of Sport Fisheries and Wildlife, Salmon-Cultural Lab., Longview, Wash.). 1969. MORTALITY DUE TO LEECH INFESTATION IN AN INCUBATION CHANNEL. Progr. Fish Cult., 31(3): 164-165.

Piscicola salmositica was demonstrated to be a factor in the survival of migrating chinook salmon (Oncorhynchus tshawytscha) in the Abernathy Channel near Longview, Washington. (Auth.)

10844. Whiteside, B.G., and Fred J. Richan (Biology Dept., Southwest Texas State College, San Marcos, Texas). 1969. REPRESSIVE FACTORS CONTROLLING REPRODUCTION IN GOLDFISH. Progr. Fish Cult., 31(3): 165.

Excretion of a hormone-like repressive factor and the accumulation of metabolic waste products in the water may be factors which prevent spawning. (Authors)

10845. Taub, Stephen H. (Massachusetts Coop. Fish. Unit, Univ. of Massachusetts, Amherst, Mass.). 1969. FECUNDITY OF THE WHITE PERCH. Progr. Fish Cult., 31(3): 166-168.

An estimate of fecundity of the white perch (Roccus americanus) was made from a sample of 10 specimens captured in Quabbin Reservoir, Massachusetts. These fish, age group III to VI, were collected on May 13, 1965, about 2 weeks before actual spawning. The 10 fish had a mean fecundity of 271,000 eggs, a range of 190,000 to 321,000. Relationships between fecundity and fish length and weight were determined. This study indicates a higher reproductive potential for white perch than previously reported. A technique for fecundity studies is suggested. (Auth.)

10846. Larson, Douglas W., and John R. Donaldson (Dept. of Fisheries and Wildlife, Oregon State Univ., Corvallis, Oreg.). 1969. THE ABILITY OF CONDITIONED RAINBOW TROUT TO DISTINGUISH BETWEEN NEIGHBORING TONES. Progr. Fish Cult., 31(3): 169-171.

Conditioned responses in 2 identical groups of rainbow trout (Salmo gairdneri) fry were developed by projecting a different tonal frequency to each group and associating that frequency with a reward or motivation. After 10 presentations of the stimulus-reward procedure, about half of the animals in each group were trained to respond to a specific tonal frequency and, subsequently, could distinguish it from a neighboring tone. (Authors)

10847. Fredenburgh, David (Massachusetts Div. of Fisheries and Game, Great Barrington, Mass.). 1969. THE POTENTIAL WEIGHT LOSS OF RAINBOW TROUT AS A RESULT OF STARVATION. Progr. Fish Cult., 31(3): 172-173.

An experiment was conducted to determine the potential weight loss and the rate of loss (the sum of the actual weight loss plus the theoretical loss) occurring when fish are starved. Four tanks were stocked with rainbow trout (Salmo gairdneri); 2 tanks were used as a control and 2 for starvation. During the first week of starvation, fish in a water temperature of 52° F had a potential weight loss of 18.64% or 2.66% per day. If 100,000 lb of trout were on hand, withholding feed for 1 day would cause a potential loss of 2,660 lb. (Auth.)

10848. Pugh, John R., Gerald E. Monan, and Jim Ross Smith (Bur. of Commercial Fisheries Biological Lab., Seattle, Wash.). 1969. ATTEMPT TO GUIDE SEAWARD-MIGRATING PACIFIC SALMON AND TROUT WITH LONG LEADS. Progr. Fish Cult., 31(3): 174-176.

The feasibility of guiding seaward-migrating Pacific salmon and trout with long leads was explored in the upper end of Brownlee Reservoir on the Snake River near Weiser, Idaho. Catches of 4 traps, 2 with long leads and 2 without, are compared. Problems involving debris, high water velocity, random movement of fish, and turbidity are discussed. Assuming equal numbers of fish were available to all traps and the holding efficiency of the traps was about the same, the long leads were unsuccessful. (Authors)

10849. Herke, William H. (Louisiana Coop. Fish. Unit, Louisiana State Univ., Baton Rouge, La.). 1969. A BOAT-MOUNTED SURFACE PUSH-TRAWL FOR SAMPLING JUVENILES IN TIDAL MARSHES. Progr. Fish Cult., 31(3): 177-179.

A new trawl design adapted for sampling in tidal marshes is described. It has an aluminum frame with a mouth width of 14 feet, will operate in less than 1 foot of water, and can be set to fish from the surface to any desired depth down to 4 feet below the surface. Pushed in front of a boat, the trawl is very maneuverable, and takes large numbers of juvenile organisms without picking up bottom debris. Major disadvantages are the cumbersome frame and the cost. (Auth.)

10850. Britten, Bryan T., and H. Vincent Resh (Dept. of Biology, Niagara Univ., Niagara University, N.Y.). 1969. TIN COATING FOR AQUARIUM COILS. Progr. Fish Cult., 31(3): 179.

Cooling coils in aquariums are electroplated with tin to prevent release of toxic ions.

10851. Robinson, William R., Jr., and Peter Vernesoni (Connecticut Board of Fisheries and Game, Hartford, Conn.). 1969. LOW-COST CIRCULAR CONCRETE PONDS. Progr. Fish Cult., 31(3): 180-182.

Low-cost circular concrete ponds were constructed by using concrete silo staves, well tile, and flush drain. Costly form work was eliminated; ponds had better circulation and self-cleaning action. (Authors)

10852. Maxon, Kenny (Colorado Game, Fish and Parks Div., Denver, Colo.). 1969. A LIVE TROUT EGG SORTER. Progr. Fish Cult., 31(3): 182-183.

A practical, electronic egg-picking machine is described. Using it, one man can process from 700,000 to 1,000,000 eggs per day.

10853. Driscoll, Donald P. (Bur. of Sport Fisheries and Wildlife, National Fish Hatchery, Marion, Ala.). 1969. SEXING THE LARGEMOUTH BASS WITH AN OTOSCOPE. Progr. Fish Cult., 31(3): 183-184.

Largemouth bass (Micropterus salmoides) were sexed with an otoscope before and after spawning. Except for the 2-year-old class, all bass were autopsied to verify the conclusions. The technique was 97% accurate. (Auth.)

10854. Maxfield, Galen H. (Bur. of Commercial Fisheries Biological Lab., Seattle, Wash.). 1969. COMPILATION OF PACIFIC SALMON LITERATURE—1900-59. Progr. Fish Cult., 31(3): 184.

The published scientific information on 5 North American species of Pacific salmon has been assembled at a single source.

10855. Inland Fisheries Commission (Hobart, Tasmania, Aust.). 1965. REPORT FOR THE YEAR ENDING 30TH JUNE, 1965. Tasmania Inland Fish. Comm. Rept., 1965, pp. 1-43. Illus.; Biological Abstracts, 49(6): Abst. No. 27126. 1968.

This report covers the administration, management, fisheries investigations, and revenue. The investigations concerned the recoveries of tagged fish, trout fry studies in Tasmania, acclimatization of Australian smelt in Tasmania, and cormorants in fish control. Management concerned itself mainly with the handling and management of the trout industry.

10856. Inland Fisheries Commission (Hobart, Tasmania, Aust.). 1966. REPORT FOR THE YEAR ENDING 30TH JUNE, 1966. Tasmania Inland Fish. Comm. Rept., 1966, pp. 1-18; Biological Abstracts, 49(6): Abst. No. 27127. 1968.

In addition to an administrative and fisheries management report, this annual report on fisheries investigations; incubation experiments with rainbow trout eggs at Greak Lake; self-supporting populations of rainbow trout; trapping trout fry; mayfly studies; blackfish; lampreys, pesticide residues; food of brown trout in estuaries of North West Tasmania; rare or endangered species of freshwater fish; and, return of fish tags. There is a financial report and an appendix which is a review of the transfer of wild brown trout from Great Lake.

10857. McDonald, A. L., and L. A. Kessel (Mont. State Univ., Missoula, Mont.). 1967. RELATIONSHIP BETWEEN SOCIAL HIERARCHY AND COLORATION IN GREEN SUNFISH [Lepomis cyanellus]. Psychol. Rep., 20(3 Part 1): 748-750; Biological Abstracts, 49(6): Abst. No. 27597. 1968.

Fifty-eight green sunfish were paired for size and placed in observation tanks. Records of attack behavior were made on each pair to determine social hierarchy position. Fifteen raters made two judgments of the darker fish of each pair. In 96.5% of the cases, the submissive fish of a pair was the darker. Several lines of research relating to social hierarchy position and coloration were suggested. (Authors)

10858. Wolf, Ken (Eastern Fish Disease Lab., Bur. of Sport Fisheries and Wildlife, Kearneysville, W. Va.). 1969. BLUE-SAC DISEASE OF FISH (ALSO KNOWN AS DROPSY, YOLK SAC DISEASE, AND Hydrocoele embryonalis). Bureau of Sport Fisheries and Wildlife Fish Disease Leaflet 15. 4 p. (Formerly Fishery Leaflet 455, revised May 1963).

10859. Coche, A. G. (Inland Fish. Br. Viale delle Terme di Caracalla, Rome, Italy). 1967. OZMOLIC REGULATIONS IN JUVENILE Oncorhynchus kisutch (Walbaum): II. CHANGES IN BLOOD CHLORIDE CONTENT OF YEARLINGS WHEN TRANSFERRED FROM FRESH TO SALT WATER. Hydrobiologia, 30(2): 293-302. Illus. (Fr. summ.); Biological Abstracts, 49(6): Abst. No. 27791. 1968.

A 48-hour period experiment was made to test the ability of yearling coho salmon to eliminate absorbed chloride when abruptly transferred from fresh to sea water. The Schale method was used to titrate chloride in the plasma and samples were taken at 0, 24- and 48-hour intervals after exposure to fresh, 15% and 30% salt water. Results show that the fish which averaged 11.5 cm in length and 13.5 g in weight were able to osmoregulate in 7.35% Cl^- sea-water. In 12.5% Cl^- concentration their body fluids showed an increasing chloride content. No mortality was recorded within 48 hours. Fish exposed for one month to estuarine sea-water succeeded in bringing their body fluid back to normal. Size is suggested as a limiting factor for the development of an efficient osmoregulatory mechanism. (Auth.)

10860. Grande, Magne (Norwegian Inst. Water Res., Oslo, Norway). 1965. AGE DETERMINATIONS FROM SCALES AND OTOLITHS IN THE BROOK TROUT (Salvelinus fontinalis Mitchell). NYTT Mag. Zool. (Oslo), 12: 35-37; Biological Abstracts, 49(6):Abst. No. 27794. 1968.

Scales and otoliths from 276 brook trout were compared with respect to their number of zones. The otoliths, prepared by a method described by Nordeng (1961) showed clear and distinct zones compared with the scales which were difficult to read. Only with scales corresponding to otoliths with 1-3 winter zones was there good correlation between the number of zones in scales and otoliths. Scales corresponding to otoliths with more than 3 winter zones showed usually a smaller number of zones than the otoliths. (Auth.)

10861. Herman, Roger Lee, and Paul E. Degurse (Bur. of Sport Fisheries and Wildlife, Eastern Fish Disease Lab., Kearneysville, W. Va.). 1967. SULFAMERAZINE RESIDUES IN TROUT TISSUES [Aeromonas, Pseudomonas, Columnaris, Corynebacterium]. Ichthyol. Aquarium J., 39(2): 73-79. Illus.

10862. Tubb, Richard A., Frederick A. Copes, and Clifford Johnston (Biol. Dept., Univ. N. Dakota, Grand Forks, N.D.). 1965. FISHES OF THE SHEYENNE RIVER OF NORTH DAKOTA. Proc. N. Dak. Acad. Sci., 19. 120-128. Map; Biological Abstracts, 49(6): Abst. No. 27822. 1968.

List of 43 spp., map and stations. Most common are Esox lucius, Semotilus atromaculatus, Notoropus cornutus, Catastomus commersoni, Ictalus melas and Culaea inconstans. --O. A. Stevens.

10863. van Duijn, C., Jr. 1967. DISEASES OF FISHES. Charles C. Thomas, Publisher: Springfield, Ill. 2nd ed. 309 p. Illus. Pr. $9.50; Biological Abstracts, 49(6): Abst. No. 27824. 1968.

Revisions appearing in this 2nd edition include coverage of new drug treatments, among them food additions and injection therapy, which have come into general use since the last edition. The volume has doubled in size, and many new illustrations have been added. Diseases caused by improper feeding, poor water conditions, the presence of toxic substances, attacks from predatory creatures, bacteria, viruses and parasites, and by injuries sustained in physical accidents are covered. This comprehensive review of the main causative agents of fish diseases and the drugs and chemicals available for their treatment forms an accurate and reliable reference source for all aquarists and pondkeepers. In addition, the information included on diseases of economic importance will be useful to all professional fish breeders. There is a subject index.

10864. Snieszko, S. F. (Eastern Fish Disease Lab., Bur. of Sport Fisheries and Wildlife, Kearneysville, W. Va.). 1969. COLUMNARIS DISEASE OF FISHES. Bureau of Sport Fisheries and Wildlife Fish Disease Leaflet 16. 3 p. (Formerly Fishery Leaflet 461 of July 1958).

10865. Wicklund, Robert (Sandy Hook Marine Lab., Bur. of Sport Fisheries and Wildlife, Highlands, N.J.). 1966. OBSERVATIONS ON THE NURSERY GROUNDS OF YOUNG SQUIRREL HAKE, Urophycis chuss. Underwater Natur., 4(1): 33-34; Biological Abstracts, 49(6): Abst. No. 27829. 1968.

Divers aboard the research vessel Dolphin encountered young squirrel hake about 6-7 inches long in August 1966, 3 miles off Monmouth Beach, New Jersey in 75 feet of water, temperature 49° F. Each fish was curled around a shell of the surf clam, Spisula solidissima. Survival of young fish may be promoted by the creation of artificial nursery grounds by dumping shell or rubble in areas where the pelagic fry might eventually seek the bottom.

10866. Hoffman, Glenn L., and Jiri Lom (Eastern Fish Disease Lab., Bur. of Sport Fisheries and Wildlife, Kearneysville, W. Va.). 1967. OBSERVATIONS ON Tripartiella bursiformis, Trichodina nigra AND A PATHOGENIC TRICHODINID, Trichodina fultoni. Wildlife Dis. Ass. Bull., 3(4): 156-159. Illus.; Biological Abstracts, 49(6): Abst. No. 31745. 1968.

A series of epizootics caused by T. fultoni is reported. Fish kept in running water at 12° C showed severe signs of trichodiniasis. At 12° C T. fultoni lacked strict host specificity but demonstrated some preference. A redescription of T. bursiformis, using the silver impregnated techniques, is given. This ciliate is reported from Acantharchus pomotis. T. nigra is reported from the same host. (Authors)

10867. Kleerekoper, H. (Dept. Biol., McMaster Univ., Hamilton, Ont., Canada). 1967. SOME ASPECTS OF OLFACTION IN FISHES, WITH SPECIAL REFERENCE TO ORIENTATION. In: Symposium on Vertebrate Olfaction, Washington, D.C., Dec. 30, 1966. Amer. J. Zool., 7(3): 385-395. Illus.; Biological Abstracts, 49(7): Abst. No. 33005. 1968.

Olfactory cues play an important role in the behavior of fishes, such as the procurement of food, recognition of sex, defense against predators, parental behavior, and orientation. By monitoring and 3-dimensional photographic techniques, analyses were made of some aspects of orientation mechanisms through olfaction. None of the marine and freshwater species investigated moved randomly in an experimental environment void of directional cues. When changing direction, the radius of the curve was fixed within fairly narrow limits and seemed to be species-specific. Left- and right-hand turns were not evenly distributed. This locomotor behavior results in a non-random pattern of relatively rigid parameters. The introduction of an odor without directional cues causes these parameters to change drastically. Invariably, the radius of the curve in changing direction decreased and the ratio of left-handed to right-handed turns was greatly changed in most experiments. When an attractant odor was introduced uni-directionally, none of the species studied could locate the source, unless the odor was associated with a differential in the rate of flow of the water. An attractant odor released rheotactic response, which was not present in the animal in the experiments previously referred to so that the localization of the source of the odor takes place through rheotaxis rather than through orienting cues provided by the odor gradient. It is possible that this mechanism forms the basis for homing orientation in those migrating species in which olfactory cues are required for the localization of spawning grounds in river systems. (Auth.)

10868. Yarzhombek, A.A. (All-Union Res. Inst. Mar. Fish. Oceanogr., Moscow, USSR). 1966. DYNAMICS OF FAT AND CAROTENOID PIGMENT IN THE GONADS OF PACIFIC SALMONS. (Dinamika zhira i karotinoidnogo pigmenta v gonadakh dal'nevostochnykh lososei). Vop. Ikhtiol., 6(1): 171-176. Illus.; Biological Abstracts, 49(7): Abst. No. 33888. 1968.

The concentration of fat in the ovaries of Pacific salmons (humpback, sockeye, and chum) increases during the marine period of their life, reaching a maximum at stage III-IV. The concentration of the carotenoid pigment astaxanthin in the salmon ovaries somewhat increases during the marine period of life. The concentration of astaxanthin in the ovaries of the sockeye, chum, and humpback salmon markedly

increases during catadromous migration and reaches a maximum by the time of fertilization. Astaxanthin possibly, is an antagonist of the products of N breakdown and metabolism forming in the tissues of salmons during the marine period of life and spawning migration, as well as during fertilization and development of the eggs. --J. Slep.

10869. Pacha, R.E. (Dept. Microbiol., Oregon State Univ., Corvallis, Oreg.). 1968. CHARACTERISTICS OF Cytophaga psychrophila (Borg) ISOLATED FROM OUTBREAKS OF BACTERIAL COLD-WATER DISEASE. Appl. Microbiol., 16(1): 97-101; Biological Abstracts, 49(7): Abst. No. 35857. 1968.

Characteristics of 10 strains of Cytophaga psychrophila isolated from a number of [salmon] epizootics of bacterial cold-water disease were compared. Morphological, cultural, biochemical, and serological data showed that the organisms were closely related. The isolates exhibited gliding motility, formed neither fruiting bodies nor microcysts, were actively proteolytic, and grew only at low temperatures. Data presented extend the description of C. psychrophila. (Auth.)

10870. Hagen, Olav (Inst. Mikrobiol. and Immunologi, Norges, Norway). 1966. THE OCCURRENCE OF SALMONELLA IN RAINBOW TROUT IN SALMONELLA INFECTED MILIEU. (Forekomst av salmonellabakterier hos regnbueorret i salmonellainfisert miljo). Nord. Vet. Med., 18(11): 513-516. Illus. (Engl. and Ger. summ.); Biological Abstracts, 49(7): Abst. No. 36067. 1968.

Fingerlings of rainbow trout showed neither clinical symptoms nor pathological-anatomical changes in the intestinal canal after being fed for 24 hours with strongly salmonella-infected fodder. The bacteria disappeared from the intestine after 48 hours, but could be demonstrated in the stomach contents a couple of days longer, probably as a result of reinfection via contaminated water. The intestinal canal in rainbow trout seems to have a bactericidal effect on salmonella bacteria, as a very strong infection is required to enable the bacteria to be discernible in the canal. Due to contamination of the reservoir water (1-2 salmonella organisms/ml) from infected bottom sludge, salmonella bacteria could be demonstrated in all the test fish when whole fish were incubated on potassium-tetrathionate broth directly from the reservoir. Surface contamination was eliminated if the fish remain for 24 hours in salmonella-free water. (Auth.)

10871. Creyssel, R., G.B. Richard, and P. Silberzahn (Inst. Pasteur, Lyon, France). 1966. TRANSFERRIN VARIANTS IN CARP SERUM. Nature, 212(5068): 1362; Biological Abstracts, 49(8): Abst. No. 38193. 1968.

The hypothesis of genetic polymorphism controlled by three existing alleles was given experimental support. Three transferrin variants in carp were defined by starch-gel electrophoresis. The theoretical frequency of the six phenotypes involved are compared statistically with the data. (From auth.)

10872. Edsall, Thomas A. (Bur. of Commercial Fisheries, Ann Arbor, Mich.). 1967. BIOLOGY OF THE FRESHWATER DRUM IN WESTERN LAKE ERIE. Ohio J. Sci., 67(6): 321-340. Illus. Map; Biological Abstracts, 49(8): Abst. No. 38563. 1968.

Information on the biology of the freshwater drum or sheepshead (Aplodinotus grunniens) was collected in Lake Erie during a fishery and limnological study made by the Bureau of Commercial Fisheries in 1957 and 1958. Growth of the sheepshead in 1958 was slower than in 1927, and slower than the growth in most other waters. Males and females grew at the same rate through the fourth year of life, but thereafter the females grew faster. Males required more than 13 years and females 11 years to reach 17 inches. A weight of 2 pounds was attained in the 12th year of life by males and in the 10th year by females. Annulus formation extended from mid-June to early August for age-groups I-IV (second through fifth year of life). Younger fish started growth earlier in the season than the older fish, and the larger, faster growing members of an age group began growth earlier than the smaller fish. The growing season in 1958 ended in early October. Bottom-water temperatures were about 65° F when growth started (mid-June) and 58° F when

growth ended. Growth was most rapid in August when temperatures were highest for the year (72° F). Growth of young of the year, but not that of older fish, was positively correlated with temperature during the 1951-57 growing seasons. The sex ratio of the 1958 samples shifted with age; age-groups I-IV contained 54% males, but older age groups had 75% males. Males matured between 7.0 and 15.9 inches (age-groups II-V) and females between 9.0 and 13.4 inches (age-groups III-VII). Spawning in 1958 reached a peak in early July, but extended from mid-June to early August. (Auth.)

10873. Mann, H. (Bundesforsch. Fischer., Hamburg, West Germany). 1965. IMPORTANCE OF DETERGENTS IN FISHING. (Die Bedeutung der Waschmittel fuer die Fischerei). Fette Seifen Anstrichm, 67(12): 977-980; Biological Abstracts, 49(8): Abst. No. 38571. 1968.

The detrimental effect of detergents on the life, growth, breeding and tast of fish is investigated. Manifestation times and lethal doses of some detergents as well as their dependence on water temperature, water O_2 content and detergent decomposition products (ammonia) are reviewed on the basis of aquarium experiments with guppies and on the basis of past observations on trout. The effect on fertilization of eggs in water and the mechanism of damage to tissues caused by surface active agents are described. The effect of molecular structure of detergents on toxicity to fish and the importance of the rate of biological decomposition of detergents are reviewed. The introduction of water purification installations for all waste water is stressed. --R. Kroha.

10874. Silberzahn, P., G. B. Richard, and R. Creyssel (Fac. Sci., Caen, France). 1967. ISOLATION AND STUDY OF PROTEINS WITH HEMOPEXIC PROPERTIES AND SERUM TRANSFERRIN FROM THE CARP (Cyprinus carpio L.). (Isolement et etude des proteines a proprietes hemopexaques et de la transferrine du serum de carpe (Cyprinus carpio L.)). Bull. Soc. Chim. Biol., 49(5): 495-506. Illus. (Engl. and Ger. summ.); Biological Abstracts, 49(8): Abst. No. 38749. 1968.

To isolate three proteins of carp serum having hemopexic properties, a fractionation schedule was developed which couples preparative agar and starch electrophoresis with gel filtration chromatography on Sephadex G 200. An antigenic similarity was found between $H\alpha_2$ and $H\alpha_1B$, both proteins having almost the same molecular weight, but different mobilities. The serum transferrins from the same animal were isolated by zone electrophoresis with Pevikon and Sephadex gel filtration. The polymorphism shown by starch gel electrophoresis is not obtained by free electrophoresis, immunoelectrophoresis or gel filtration. (Authors)

10875. Van Citters, Robert L., and Nolan W. Watson (Univ. Wash. Sch. Med., Seattle, Wash.). 1968. CORONARY DISEASE IN SPAWNING STEELHEAD TROUT Salmo gairdnerii. Science, 159(3810): 104-107. Illus.; Biological Abstracts, 49(8): Abst. No. 39267. 1968.

Coronary degeneration was absent in young trout taken in fresh water and rare in immature fish at sea, but the incidence and severity were sharply greater in migrating fish and almost uniformly present in spawning fish. Several fish taken after they had reentered salt water after spawning had no lesions; lesions in fish taken during their second spawning migration were not cumulative. These facts suggest that the process is reversible. (Authors)

10876. Cole, H., A. Bradford, D. Barry, P. Baumgarner, and D. E. H. Frear (Dept. Plant Pathol., Pennsylvania State Univ., University Park, Pa.). 1967. PESTICIDES IN HATCHERY TROUT: DIFFERENCE BETWEEN SPECIES AND RESIDUE LEVELS OCCURRING IN COMMERCIAL FISH FOOD. Pestic. Monit. J., 1(2): 35-37; Biological Abstracts, 49(8): Abst. No. 40178. 1968.

Samples of commercial fish food from four manufacturers and trout of three species, brook, brown, and rainbow, were analyzed for persistent chlorinated pesticides. The trout were in the 8- to 9-inch size range at the time of analysis. Small quantities of heptachlor, heptachlor epoxide, dieldrin, DDE [Dichlorodiphenyl

dichloroethylene], DDD [Dichloro-diphenyl dichloroethane] (TDE) o, p'-DDT, and p, p'-DDT were found in the fish food. One source contained all of the pesticides except DDD. The trout were analyzed on the basis of chloroform-methanol extractable lipids from the whole fish. The rainbow trout with one exception contained all seven pesticides. The rainbow trout contained greater quantities of all pesticides than the brook or brown trout. The brown trout contained significantly more heptachlor, heptachlor epoxide, dieldrin, DDE, and DDD than the brook trout. (Authors)

10877. Wild, Charles E., Jr., and Richard B. Crawford (Sch. Dent. Med., Univ. Penn., Philadelphia, Pa.). 1966. CELLULAR DIFFERENTIATION IN THE ANAMNIOTA. III. EFFECTS OF ACTINOMYCIN D AND CYANIDE ON THE MORPHOGENESIS OF Fundulus. Exp. Cell. Res., 44(2/3): 471-488. Illus.; Biological Abstracts, 49(8): Abst. No. 40745. 1968.

Fertilized eggs and embryos of Fundulus heteroclitus reared in solutions of Actinomycin D for 24 hours exhibited strikingly different failures of morphogenesis upon the time of initiation of the treatment. While morphogenesis was irreversibly inhibited cellular differentiation occurred. These two areas of development are therefore separable in time. The most severe effects, failure of gastrulation and axiation, occurred when the incubation period began immediately upon fertilization. Failure of cephalogenesis occurred when the incubation period began one hour after fertilization. Incubation of later onset (2 hours) led to microcephaly. Incubation beginning at blastulation had no effect on embryogenesis. Preincubation in cyanide until high blastula (stage 9) followed by incubation in Actinomycin D, led to failure of axiation similar in all details to the effect seen with incubation in Actinomycin D which included the first hour after fertilization. The Actinomycin D sensitive period of development therefore is dependent upon aerobic metabolism. Incubation of sperm in Actinomycin D prior to fertilization led to a severe mortality but no effect on morphogenesis in the survivors. Incubation of eggs, or eggs and sperm led to failure of development past the blastula. (From auth. abst.)

10878. Hodgins, Harold W., Russell S. Weiser, and George J. Ridgway (Bur. of Commercial Fisheries Biological Lab., Seattle, Wash.). 1967. THE NATURE OF ANTIBODIES AND THE IMMUNE RESPONSE IN RAINBOW TROUT (Salmo gairdneri). J. Immunol., 99(3): 534-554. Illus.; Biological Abstracts, 49(8): Abst. No. 40946. 1968.

Rainbow trout were immunized with three purified soluble proteins of different molecular sizes: BSA (bovine serum albumin), BGG (bovine gamma globulin) and KLH (keyhole limpet hemocyanin). Passive hemagglutinating antibodies were detected in a few of the trout anti-BSA sera on the 31st day and precipitins on the 73rd day after the initial injection of antigen. Only a small number of BAS-injected trout developed detectable antibodies at any interval. No detectable antibodies to BGG were produced by rainbow trout during a 5-month period of immunization. Specific anti-KLH precipitating antibodies were detected by the 22nd day after initial injection of antigen and were eventually produced by all surviving KLH-injected trout. Rainbow trout isoimmune hemagglutinating antibodies resided in a serum fraction which contained 10.5 S and 13.5 S components. They migrated as β-globulins in immunoelectrophoresis. No large- to small-molecule production shift analogous to the 19 S to 7 S production-shift in mammals was observed with either rainbow trout isoimmune hemagglutinating or immune precipitating antibody. Specific natural anti-rabbit (red blood cell) hemagglutinins of rainbow trout sera consisted of both large and small molecules. These natural hemagglutinins represent distinctly different molecular species than immune isohemagglutinins. The natural hemolytic activity of rainbow trout serum was in some respects similar to that of the antibody-complement systems of other species. However, it differed in that heat-inactivated trout sera could not be reactivated by various complements and sera, that heterologous or homologous antibody or guinea pig complement did not increase serum titers and that ammonium hydroxide did not significantly affect hemolysis by trout serum. (Authors)

10879. Waters, Barbara, and John Waters. 1967. SALT-WATER AQUARIUMS. Holiday House: New York. 161 p. Illus. Pr. $3.95; Biological Abstracts, 49(9): Abst. No. 43364. 1968.

This volume is a guide to the purchase and construction of salt water aquariums. Information is given on the proper form of collection and ordering of marine invertebrates and fish, and on how to keep them healthy and active in artificial sea water. Advice is given on the proper handling and experimenting with small marine animals. The many types of animals suitable for a salt water aquarium are discussed. An appendix offers a list of equipment, supply sources, animal groupings and suggested readings. The book is illustrated with line drawings and photographs. There is a subject index.

10880. Berman, Sh., and A. Ziedin'. 1965. GROWTH DYNAMICS OF THE TRACE ELEMENTS IRON, COPPER AND MANGANESE IN RIVER TROUT. (Vozrastnaya dinamika mikroelementov zheleza, medi i margantsa v organizme ruch'evoi foreli). Uch. Zap. Latv. Univ., 67. 35-43 (Ger. summ.). From: Ref. Zh., Biol., 1966, No. 10I115. (Translation); Biological Abstracts, 49(9): Abst. No. 43855. 1968.

The trace elements were determined by spectroscopic methods in muscles, liver, gills and gonads of river trout of ages 1+ to 4+. The largest amounts were found in liver, the amount of Fe being greater than that of Mn and Cu. As the fish grows the content of Cu, Mn and Fe in the gonads increases; in liver the content of Cu and Fe decreases with growth. In all the organs examined Mn content increased with growth.

10881. Dzhelineo, St. 1966. ACTIVITY AND HEMOGLOBIN CONCENTRATION OF MARINE FISHES. (Aktivnost' morskikh ryb i kontsentratsiya gemoglobina u nikh). In: Ecology of aquatic organisms. Nauka: Moscow. 155-161. From: Ref. Zh., Biol., 1967, No. 1I108K. (Translation); Biological Abstracts, 49(9): Abst. No. 43860. 1968.

From daily observations on the mobility of fishes, without regard to its causes other than flight from enemies and dispersal, fishes differ significantly in spontaneous activity. This confirmed the previous division of fishes into very active, active, and inactive. Studies on O_2 consumption at an adaptation temperature of 12.5° C revealed that active fish use up O_2 more rapidly than inactive ones. Hemoglobin concentration is affected by the fish's mobility, expressed in spontaneous activity, and by O_2 consumption in a state of rest. The most active fish had the highest hemoglobin concentration. The experiments were carried out with six fish species from the Adriatic Sea.

10882. Pomazovskaya, I. V. 1966. A PHYSIOLOGICAL ANALYSIS OF YOUNG ATLANTIC SALMON REARED IN THE VYG FISH HATCHERY. (Fiziologicheskaya otsenka molodi semgi, vyrashchivaemoi na Vygskom rybovodnom zavode). In: Summaries of reports. All-Union conference on the ecology and physiology of fishes, 1966. Moscow. 45-46. From: Ref. Zh., Biol., 1966, No. 10I155. (Translation); Biological Abstracts, 49(9): Abst. No. 43897. 1968.

Moisture content, dry residue, raw protein, fat content and O_2 uptake rate were determined in tank-reared fingerling and yearling Atlantic salmon fed a regular diet supplemented with Co (0.08 mg/kg fish weight), and also in those fed natural foods. No substantial differences in the indices investigated were noted. In yearlings receiving Co the water content in the body was higher and protein and fat content lower. Weight increments of fish receiving Co were slightly higher.

10883. Shekhanova, I. A. 1966. UPTAKE OF BIOGENIC ELEMENTS BY DEVELOPING FISH EGGS. (Usvoenie biogennykh elementov ikroi ryb v protseesse razvitiya). In: Summaries of reports. All-Union conference on the ecology and physiology of fishes, 1966. Moscow. 84-85. From: Ref. Zh., Biol., 1966, No. 10I118. (Translation); Biological Abstracts, 49(9): Abst. No. 43905. 1968.

The distribution in trout eggs of P^{32}, C^{14}, and Ca^{45}, absorbed from water, was investigated. The bulk of Ca (80%) accumulates in the yolk; 20-25% of the P is also found in yolk and embryo; 30-50%, in the egg membrane. Among the elements investigated, P is absorbed most intensively.

10884. Ostroumova, I. N. 1966. BLOOD SERUM PROTEIN OF SALMONID FISHES. (Belkovyi sostav syvorotki krovi lososevykh ryb). In: Summaries of reports. All-Union conference on the ecology and physiology of fishes, 1966. Moscow. 103-104. From: Ref. Zh., Biol., 1966, No. 10I106. (Translation); Biological Abstracts, 49(9): Abst. No. 44564. 1968.

Blood serum proteins were studied by paper electrophoresis in salmon from the White, Barents and Baltic Seas, in salmon from Ladoga Lake, in sea trout and rainbow trout. α-, β- and gamma-globulins were found in these fishes. The last fraction was very small. A high type specificity of serum proteins was noted. Physiological changes (with age, etc.) affected only the quantitative character of certain protein fractions.

10885. Price, Charles E., and Thomas E. McMahon (Augusta College, Augusta, Ga.). 1967. A NEW MONOGENETIC TREMATODE FROM THE GOLDEN SHINER. J. Tenn. Acad. Sci., 42(4): 113-114. Illus.; Biological Abstracts, 49(9): Abst. No. 48280. 1968.

Host specimens of the golden shiner (Notemigonus crysoleucas) were examined for presence of gill parasites. Two specimens of a viviparous monogenean, Gyrodactylus rachelae, were recovered and morphologically described. This study constitutes the first record of a parasite belonging to the superfamily Gyrodactyloidea from the state of Georgia, USA.

10886. Ridgway, G. J. (Bur. of Commercial Fisheries, Boothbay Harbor, Me.). 1967. A COMPLEX BLOOD GROUP SYSTEM IN SALMON AND TROUT. In: 10th European conference on animal blood groups and biochemical polymorphisms. July 5-8, 1966. Paris, France. Institut National de la Recherche Agronomique: Paris, France. 362-365. Illus. (Fr. summ.); Biological Abstracts, 49(10): Abst. No. 48989. 1968.

A 12-factor system of blood groups was detected in sockeye salmon (Oncorhynchus nerka) and rainbow trout (Salmo gairdneri) with antisera prepared by isoimmunization of the rainbow trout. Statistical tests of independence, patterns of cross-reactivity, and preliminary genetic information from rainbow trout indicate that this is a complex multiple allelic system which resembles the B system of cattle and the Rh system of man. (Auth.)

10887. Gubanova, I. F., and N. V. Vershinin. 1965. SIGNIFICANCE OF THE EPIFAUNA OF THE FLOODED FOREST IN THE BIOLOGICAL CONDITIONS OF THE KAMSKOE RESERVOIR. (1965). (Znachenie epifauny zatoplennogo lesa v biologicheskom rezhime Kamskogo vodokhranilishcha. (1965 god)). Uch. Zap. Perm. Univ., 125. 119-125. From: Ref. Zh., Biol., 1966, No. 5D203. (Translation); Biological Abstracts, 49(10): Abst. No. 49210. 1968.

Observations of the epifauna of the drowned forest were made in the second year of the existence of the Kamskoe Reservoir (May through October 1955) in the Ust'-Garevaya region. In order to ascertain the rate of settlement by the hydrobionts on different tree species, spruce, pines, and bundles of birch branches were almost submerged. (The experiment lasted 62 days). The trees were then taken from the water and a count was made of all fauna. The fauna of trees with roots still embedded were gathered from branches of these trees cut off under water. Phytophilic larvae of chironomids were the first to be found on all species of sunken trees: (Endochironomus of the tendens group and Cryptochironomus of the pararostratus group which gradually yielded to the dendrophilic forms as the leaves and needles decayed. The biomass of the chironomid larvae fluctuated from 1.7 to 3.9 g/m^3. The biomass of mollusks increased toward the end of the experiment (Planorbis planorbis, Anisus contortus, and Gyraulus gredleri). Crustacean population (Asellus aquaticus) reached a maximum during the period of decay of the leaves, birches, and bark of the conifers. The greatest biomass of epifauna was noted on the birches on the 10th day (22.7 g/m^2); on the spruce it reached a maximum of 10.9 g/m^2 at the end of the experiment. The biomass of epifauna of the tree species exceeds the benthos by about 7 times. It is used as food by fish (perch, roach).

10888. Almazov, A. M., V. I. Vladimirov, and Ya. Ya. Tseeb. 1966. CHANGES IN THE AQUATIC ENVIRONMENT AND IN THE REPRODUCTION OF DNIEPER FISH STOCKS AS A RESULT OF FLOW REGULATION. (Ismenenie rezhima i estestvennogo vosproizvodstva rybnykh zapasov Dnepra v usloviyakh zaregulirovannogo stoka). In: Hydroelectric development and fish culture in the lower Ob. Nauka: Moscow. 110-119. From: Ref. Zh., Biol., 1967, No. 11151. (Translation); Biological Abstracts, 49(10): Abst. No. 49343. 1968.

A cascade from six reservoirs will be completed on the Dnieper in the near future. In an 8-year period (1956-63) the sea run-off decreased by 20% as a result of damming, and it will decrease by 78% over the subsequent 15 years. Pollution in the reservoirs has been increasing, causing summer fish-kill (Kakhovsk and Kremenchug Reservoirs). The mineral content of the water dropped and there was an excessive increase of blue-green algae. The greatest harm to the reproduction of migratory fishes (sturgeon, shad) was caused by the construction of the Kakhovsk Hydroelectric Plant, 91 km from the Dnieper's mouth. Only in 1958, a year abounding in water, was the shad's spawning of the same intensity as before. Over the past five years the sturgeon has completely disappeared from the river. In spawners disruption of gamete development was observed, which apparently explains the increased mortality of eggs and larvae. The reproductive capacity of semi-migratory species (bream, Azov roach, chekhon and others) fell off markedly owing to the decrease of flooded areas and instability of the aquatic environment. The fish fauna of all the Dnieper reservoirs had acceleration of growth rate, reduced size of first-time spawners and displacement of spawning periods. To improve the reproductive conditions in the reservoirs, the water level should be controlled and artificial spawning grounds constructed. Introduction of plankton-eaters (blue-bream, silver carp) would be expedient.

10889. Ginzburg, Ya. I. 1965. EFFECT OF THE REGULATION OF THE VOLGA ON THE REPRODUCTION OF DIADROMOUS STURGEONS AND ON THE BIOLOGY OF THEIR YOUNG. (Vliyanie zaregulirovaniya Volgi no razmnozhenie prokhodnykh osetrovykh i biologiyu ikh molodi). Tr. Volgograd Otd Gos Nauch-Issled Inst. Ozer Rechn Rybn Khoz, 2: 79-131. From: Ref. Zh., Biol., 1966, No. 9I90. (Translation); Biological Abstracts, 49(10): Abst. No. 49367. 1968.

The observations were made up to the time of the formation of the reservoir in 1958-61 in the Saratov area as far as the village of Raigorod in the Volgograd Reservoir, and below the dam of the hydroelectric power plant up to the villages Svetlyy Yar and Raigorod. Control of the flow of the Volga changed the flood time below the dam and affected both the water content of the river and the thermal regime of the sturgeons' spawning season. Because of the curtailment of spawning grounds, the sturgeons were forced to spawn in a restricted part of the river off Volgograd. Between Saratov and the village Svetlyy Yar, the sturgeons spawned in the summer of 1958 under usual conditions, and the young of the year remained in the new body of water. From November 1958 diadromous sturgeons no longer migrated above Volgograd to spawn. The escapement of the sturgeons in the reservoir in the second half of 1958 was followed by mass spawning upstream in the following year. The young of this year class grew rapidly, and the 1959 year class descended to the Caspian for a number of years in good condition. In the spring of 1959 the majority of hiemal sturgeons spawned upstream, while the majority of vernal sturgeons spawned below the dam. In 1960 and 1961 hiemal and vernal sturgeons were forced to spawn below the dam (except for those that were transferred to the reservoir). Sturgeons below the dam spawned under both favorable and unfavorable conditions. Up to the regulation of the flow, young sturgeons in the river were represented by larvae, fry and fingerlings. From 1959 onward, owing to the proximity of spawning grounds, they were represented only by yolk-sac larvae. Their growth rate in the river declined, and they entered the estuaries at a smaller size than did the young before the construction of the dam.

10890. Roberts, R. J., W. M. Shearer, A. L. S. Munro, and K. G. R. Elson. 1969. THE PATHOLOGY OF ULCERATIVE DERMAL NECROSIS OF SCOTISH SALMON. J. Pathol., 97(3): 563-564.

10891. Karpevich, A. F. 1966. SALINITY REQUIREMENTS OF GRASS AND SILVER CARP TRANSPLANTED TO BRACKISH WATERS. (Trebovaniya belogo amura i tolstolobika k solennosti vodi pri vselenii ikh v solonovatye vodoemy). In: Cultivation of herbivorous fishes. Nauka: Moscow. 89-94. From: Ref. Zh., Biol., 1966, No. 10I96. (Translation); Biological Abstracts, 49(10): Abst. No. 49372. 1968.

Survival rate was investigated in eggs, larvae and fry of grass and silver carp in Black Sea, Caspian and Aral waters of different salinity. Spermatozoa retained mobility in Black Sea water of up to 6.3-7.6‰ salinity. Normal development proceeded in Black Sea water when the salinity was increased to 4.6‰; in Caspian water, to 6‰. Larvae of grass carp developed in Black Sea water when the salinity was increased to 7.6‰, and larvae of silver carp developed when the salinity was increased to 4.9‰. In Caspian water larvae of both species developed normally when the salinity was increased to 6‰. Grass-carp fry of ages 3-4 weeks withstood a salinity increase of from 0 to 9‰ in Caspian water, and from 0 to 12‰ in Aral water; silver carp fry to 7.5 and 10.5‰, respectively. Thus, the eggs of herbivorous fishes can develop in brackish water and fry in saline water.

10892. Koshelev, B. V. 1966. SOME CHARACTERISTICS OF THE REPRODUCTIVE CYCLE OF FISHES WITH SYNCHRONOUS AND ASYNCHRONOUS OOCYTE DEVELOPMENT IN WATERS OF DIFFERENT LATITUDES. (Nekotorye osobennosti polovykh tsiklov u ryb s sinkhronnym i asinkhronnym rostom ootsitov v vodoemakh razlichnykh shirot). In: Abundance dynamics patterns of fishes of the White Sea and of its Basin. Nauka: Moscow. 79-92. From: Ref. Zh., Biol., 1967, No. 11132. (Translation); Biological Abstracts, 49(10): Abst. No. 49375. 1968.

The general principles concerning variation in the fish reproductive cycle in relation to the spawning pattern are formulated. A change in living conditions may change the time of sexual maturation of young individuals and the time of cessation of reproductive capacity of adults. Changes in reproductive cycles were studied in greater detail in mature individuals. In synchronous oocyte development and a single spawning, disruption of reproductive conditions leads to a long-term disruption of the reproductive cycle. In asynchronous oocyte development and intermittent spawning, under unfavorable conditions, only one of several spawning cycles drops out in a season. Factors determining the duration of the spawning period in fish with different spawning patterns are analyzed. During adaptation to living conditions in water-masses of different latitudes, changes may occur in the duration of individual ovarian maturation stages, as well as in the number of egg batches deposited. In some species both the spawning pattern and the synchronism of oocyte development may change.

10893. Kuderskii, L. A. 1966. ON THE PERIODICITY OF CATCHES OF FISH HAVING A LONG LIFE-CYCLE IN KARELIAN LAKES. (O periodichnosti ulovov ryb a dlitel'nym zhiznennym tsiklom v ozerakh Karelii). Tr. Karel Otd Gos Nauch-Issled Inst. Ozer Rechn Rybn Khoz, 4(2): 85-92. From: Ref. Zh., Biol., 1967, No. 11178. (Translation); Biological Abstracts, 49(10): Abst. No. 49376. 1968.

Observations are presented on the catches of pike-perch, bream and salmon in Karelian lakes between 1944 and 1962. Although the catch dynamics of these species show a well-marked periodicity, it varied from one body of water to another for the same species. Thus, in Syamozero the maximum catches of pike-perch occurred every 6-7 years, in Vodlozero every 4 years, in Ladoga and Onega lakes every 4-5 years. The maximum catches of bream were recorded in Vygozero every 4-5 years, in Onega Lake every 3-4 years, in Vodlozero every 2-4 years, in Syamozero every 5-6 years, and in the Karelian part of Lake Ladoga every 7 years. There was a 6-year periodicity in the fluctuations of the salmon stock in Lake Onega, and 6-7 years in the Karelian part of Lake Ladoga. It is suggested that the periodicity of the catches was determined by periodic fluctuations in environmental conditions.

10894. Matsushima, Masashiro, and Sergio S. Felix (Philippine Fish. Comm., Manila, Philippines). 1966. MODIFICATION OF THE SEXUAL CYCLE IN "WAKIN" Carassius carassius BY HORMONE INJECTION AND WITH REGULATED ENVIRONMENTAL CONDITIONS. Freshwater Fishers. Res. Lab. Bull., 16(2): 90-102; Biological Abstracts, 49(10): Abst. No. 49386. 1968.

The experiments were performed to accelerate the maturation and induce spawning of the goldfish "Wakin", under the influence of environmental conditions (water temperature and artificial shower), combined with the pituitary hormone injection. In many cases, after treating with the artificial shower or transferring into regulated higher water temperature, the activities of breeders increased. Comparing the efficiency of injections between the injected and the uninjected group, in most cases the injected groups showed more success in spawning results, many eggs and high value of gonad index. The initial spawning took place approximately two months earlier than the usual spawning time. (Authors)

10895. Scott, W. B. 1967.- FRESHWATER FISHES OF EASTERN CANADA. 2nd ed. Univ. of Toronto Press: Toronto, Ont., Canada. x+137 p. Illus. Map. Pr. $1.95; Biological Abstracts, 49(10): Abst. No. 49402. 1968.

From the more than one million square miles of the six eastern provinces of Canada, 154 spp. of freshwater fishes have been reported. This edition provides the game and commercial fisherman and the naturalist with detailed information regarding these fishes and assists in the accurate identification of the various species. The species are arranged phylogenetically. Each description includes a picture, a list of common names, the distinguishing features, size, habitat, life history and habits, food and additional comments. Technical language has been avoided where possible but with no loss of accuracy. There is a list of references, and a subject index.

10896. Shiraishi, Yoshikazu, and Yoshimi Fukuda. 1966. THE RELATION BETWEEN DAY LENGTH AND THE MATURATION IN FOUR SPECIES OF SALMONID FISH. Freshwater Fishers. Res. Lab. Bull., 16(2): 103-111. Illus.; Biological Abstracts, 49(10): Abst. No. 49407. 1968.

The experiment was carried out on four mature salmonid fishes at the same time, so that the hybrids between these fishes could be produced artificially. Fishes used were rainbow trout, brook trout, kokanee and chuzenjii-masu. Each experimental pond was illuminated for desired hours every day by using black vinyl sheets, sun light, and two 20-watt fluorescent lamps. The temperature of water was kept at about 9.0° C. In each pond 400 fish which were composed of 100 fish of each species were reared, and five of each species of fish were sampled every 15 days. The weight of body, the weight of gonads and egg diameter were measured. The number of functionally matured fish was counted every 10 days after the beginning of spawning season. The fish of 8-hour day-time had accelerated maturation, and they spawned 1 or 1-1/2 months earlier than the fish under natural light condition. The fish of 0-hour day-time spawned next. The fish of 16- and 24-hour day-time had retarded maturation, and they spawned 2 to 3 months later than the fish under natural light condition. Male fish of all species always matured 1 or 2 months earlier than females. The maturation of kokanee and Hon-masu was earlier than that of rainbow trout and brook trout, especially short day-length condition. (Authors)

10897. Shlyumpberger, V. 1966. DETERMINATION OF THE SALT TOLERANCE OF PIKE (Esox lucius) BY MEANS OF Na^{22}. (Opredelenie soleustoichivosti shchuki (Esox lucius) s pomoshch'yu Na^{22}). In: Ecology of aquatic organisms. Nauka: Moscow. 161-167. From: Ref. Zh., Biol., 1967, No. 11118K. (Translation); Biological Abstracts, 49(10): Abst. No. 49408. 1968.

In connection with the sharp fluctuations in salinity on the lagoons and in the bays of the Baltic Sea in the German Democratic Republic, where fishery operations are conducted, an investigation was made into the salt tolerance of pike (adults and young). The fish were placed in a solution containing the isotope Na^{22}, then in water with varying salinity. The periods of absorption and excretion of Na^{22} were

measured by means of a special apparatus. The rate of Na^{22} excretion was found to rise with increased salinity. At 11.33 - 12.4 $^{o}/_{oo}$ salinity, impairment of mobility and sideward inclination of the body were observed. In the fresh water, up to 65% of the total Na^{22} content was excreted from the fish's perivisceral fluid. After they were transferred from fresh to salt water, the Na^{22} excretion rate increased within 5-15 hours. On transfer from salt to fresh water, the Na^{22} excretion rate fell off within 10 hours. The experiments were carried out not only with adults but also with immature fish.

10898. Shpet, G.I., and N.N. Kharitonova. 1965. EFFECT OF DUCK FEEDING ON INCREASING FISH PRODUCTION OF CARP PONDS. (Vliyanie vygula utok na povyshenie ryboproduktivnosti krupnykh karpovykh prudov). Rybn Khoz Respub Mezhved Temat Nauch Sb 2. 56-61. From: Ref. Zh., Biol., 1966, No. 10I178. (Translation); Biological Abstracts, 49(10): Abst. No. 49409. 1968.

The ducks were raised in large and small Ukrainian ponds. In large ponds fish production increased 1.5 to 1.75 times. Benthos biomass increased. In large ponds only the area in the vicinity of nesting areas was fertilized by the ducks; in small ponds, the entire area was fertilized. Stocking densities should be based on the volume of water that flows through the pond. The optimal amount was found to be 240-300 m^3/duck/year. For a more complete exploitation of duck droppings, bird pens should be constructed in the central and upper section of the pond, not near the dam.

10899. Sisk, Morgan (Murray State College, Murray, Ky.). 1966. UNUSUAL SPAWNING BEHAVIOUR OF THE NORTHERN CREEK CHUB, Semotilus atromaculatus (Mitchill). Trans. Ky. Acad. Sci., 27(1/2): 3-4; Biological Abstracts, 49(10): Abst. No. 49410. 1968.

Mass spawning in small riffle-connected pools in June is described. The late spawning, lack of nest building, and unusual behavior is postulated as being due to a cool, rainy spring that made the normal spawning areas unsuitable at the normal spawning period. --R.H. Weaver.

10900. Sokolov, V.A. 1965. TUNA STUDIES IN THE GULF OF MEXICO AND IN THE CARIBBEAN SEA IN 1964-1965. (Issledovanie tuntsov Meksikanskogo zaliva i Karibskogo morya v 1964-1965 gg). In: Soviet-Cuban fisheries research. Pishch. Prom: Moscow. 209-221 (Span. summ.). From: Ref. Zh., Biol., 1966, No. 9I187. (Translation); Biological Abstracts, 49(10): Abst. No. 49412. 1968.

The most important item of the tuna fishery in the Gulf of Mexico and the Caribbean Sea is the yellowfin tuna; bluefin, bigeye, albacore and blackfin tuna are less important. In summer very large concentrations of yellowfin tuna were found in the northern part of the Gulf of Mexico, adjacent to the Mississippi Delta. In winter the tuna schools move south, chiefly into the Gulf of Campeche. Tuna schools in the Caribbean occur mainly in regions of upwelling abyssal waters. The size of the stocks depends on the number of individuals that come here from the Atlantic Ocean. An increase in the exploitation of the Gulf of Mexico and the Caribbean Sea appears possible.

10901. Todd, W.R., L. E. Laastuen, and A.E. Thomas (Univ. Oreg. Med. Sch., Portland, Oreg.). 1967. EFFECT OF AMINO ACID IMBALANCE ON LIVER GLYCOGEN LEVELS IN YOUNG SALMON. Comp. Biochem. Physiol., 23(2): 431-435. Illus.; Biological Abstracts, 49(10): Abst. No. 49724. 1968.

Stressed young salmon fed a diet containing 10% glycine showed a higher level of liver glycogen than those fed a basic diet without glycine added. When L-tyrosine was prefed with the glycine diet, liver glycogen was the same as in fish prefed the basic diet. It was suggested that a cellular amino acid imbalance was induced by the high glycine intake, with L-tyrosine as one of the limiting amino acids. In a deficiency of L-tyrosine, cellular amino acids are presumably not utilizable for protein biosynthesis. The deaminated chains of several are therefore available for carbohydrate formation. Feeding L-tyrosine corrects this. (Authors)

10902. Davies, P. M. C. (Dept. Zool., Univ. Nottingham, Nottingham, England). 1967. THE ENERGY RELATIONS OF Carassius auratus L.: III. GROWTH AND THE OVERALL BALANCE OF ENERGY. Comp. Biochem. Physiol., 23(1): 59-63. Illus.; Biological Abstracts, 49(10): Abst. No. 49727. 1968.

No simple relationship was observed between either gross or net efficiencies of growth and food input. Net efficiencies of growth were highest when food intake just exceeded the maintenance requirements. A tentative energy balance-sheet was drawn up for goldfish at 21.5° C. (Auth.)

10903. Rosen, Lawrence, E. L. Murray, and G. David Novelli (Oak Ridge Natl. Lab., Biol. Div., Oak Ridge, Tenn.). 1967. CELL-FREE INCORPORATION OF AMINO ACIDS BY A [Salmo gairdneri] TROUT-LIVER SYSTEM. HEAT-LABILE AMINOACYL TRANSFERASE ACTIVITY. Can. J. Biochem., 45(12): 2005-2014. Illus.; Biological Abstracts, 49(10): Abst. No. 49769. 1968.

A cell-free system from trout liver that incorporates amino acids into protein was isolated. The system requires both soluble and particulate fractions, and is similar to those isolated from other organisms. The incorporation of amino acids is extremely heat-labile, and this lability has been localized in the aminoacyl transferase activity of the cell sap. The heat lability of the microsomes may also be related to transferase activity. Ribosomal fractions from trout liver and rat liver incorporate amino acids when incubated with cell sap from rat liver and trout liver, respectively. (Authors)

10904. Wilkins, N. P. (Marine Lab., Aberdeen, Scotland). 1967. IMMUNOLOGY, SEROLOGY AND BLOOD GROUP RESEARCH IN FISHES. In: 10th European conference on animal blood groups and biochemical polymorphisms. 5-8 July, 1966. Paris, France. Institut National de la Recherche Agronomique: Paris, Fr. 355-359. Illus. (Fr. summ.); Biological Abstracts, 49(10): Abst. No. 51917. 1968.

Individual variations in erythrocyte agglutinogens, serum antigens and hemoglobin within a number of marine fish species are presented. The phylogenetic and ontogenetic variations, which are of value in fishery research are discussed. (Auth.)

10905. Allison, Terry C., and J. Leon McGraw (Dept. Biol., Texas Agr. and Mech. Univ., College Station, Texas). 1967. THE HELMINTH PARASITES OF CENTRARCHIDAE FROM THE NAVASOTA RIVER SYSTEM OF TEXAS. Tex. J. Sci., 19(3): 326-328; Biological Abstracts, 49(10): Abst. No. 53754. 1968.

From June 11 to October 24, 1963, 87 centrarchid fish representing 5 species (Micropterus salmoides, Pomoxis annularis, Lepomis cyanellus, L. macrochirus, and L. megalotis) were collected and examined for visceral and gill helminth parasites. Twenty-nine species of parasites were found, including cestodes, nematodes, acanthocephalans, digenetic and monogenetic trematodes. These parasites and the percentage of infestations are reported. Three new host records for monogenetic trematodes are recorded. (Authors)

10906. Cordonnier, Lorna M., and Helen L. Ward (Dept. Zool. and Entomol., Univ. Tenn., Knoxville, Tenn.). 1967. Pomphorhynchus rocci SP. N. (ACANTHOCEPHALA) FROM THE ROCK BASS, Roccus saxatilis. J. Parasitol., 53(6): 1295-1297. Illus.; Biological Abstracts, 49(10): Abst. No. 53766. 1968.

The new species, found in two of three rock bass from the coastal region of North Carolina, is described and compared with other species of Pomphorhynchus. It differs from them in having 15 to 18 proboscis hooks in each longitudinal row. Other species have a maximum of 14 hooks in each longitudinal row. (Authors)

10907. Willoughby, L. G. 1969. SALMON DISEASE IN WINDERMERE AND THE RIVER LEVEN; THE FUNGAL ASPECT. Salmon Trout Mag., No. 186. pp. 124-129.

10908. Reigle, Norman J., Jr. (Bur. Commercial Fisheries, Ann Arbor, Mich.). 1969. BOTTOM TRAWL EXPLORATIONS IN LAKE SUPERIOR, 1963-65. U. S. Fish and Wildlife Service Circular 294. 25 p.

10909. Kuzema, A.I., and V.G. Tomilenko. 1965. PRODUCTION OF NEW CYPRINID FISHES BY REMOTE HYBRIDIZATION. (Vyvedenie novykh karpovykh ryb metodom otdalennoi gibridizatsii). Rybn Khoz Respub. Mezhvedom Temat Nauch Sb 2. 3-17. From: Ref. Zh., Biol., 1966, No. 11I201. (Translation); Biological Abstracts, 49(11): Abst. No. 54852. 1968.

Female Chinese crucian carp (Carassius auratus) were crossed with male lake goldfish (Carassius carassius) of European origin, and also female C. carassius with male C. auratus. Although the hybrid offspring were self-sterile, a few female among them had well-developed sex glands. Some females gave offspring with goldfish males. Tertiary hybrids were self-sterile. Examination of sex glands of year-old and 2-year-old tertiary hybrids revealed 50% females, 16% males and 33% individuals of indefinite sex. Inasmuch as the number of individuals suitable for breeding increases in each generation, it is presumed that the fertility of the new form will attain a level characteristic of the parental form. A valuable character of tertiary hybrids is their resistance to red-spot disease. Meristic features of tertiary offspring were compared with those of the parents, and their viability and growth rate assessed. Crossing of goldfish and C. auratus females with Ropshin carp males gave carp-crucian carp hybrids. Female carp-crucian carp hybrids were mated with male tertiary hybrids and male Ropshin carp. Offspring hybrids were obtained in both cases. Carp-crucian carp hybrids exhibit considerable variability of growth and exterior, which is evidence of their high plasticity as well as of the possibility of obtaining more fertile strains through selective breeding.

10910. Magnin, Etienne, and Gerard Beaulieu (Dept. Biol., Univ. Montreal, Montreal, Que., Canada). 1967. THE BASS, Roccus saxatilis, IN THE ST. LAWRENCE RIVER. (Le bar, Roccus saxatilis (Walbaum), du fleuve Saint-Laurent). Natur. Can., 94(5): 539-555. Illus. Map. (Engl. summ.); Biological Abstracts, 49(11): Abst. No. 54854. 1968.

In this survey, 3,105 specimens of striped bass, R. saxatilis, captured in the St. Lawrence River were utilized. Relations between the total length and the fork length, and between the logarithm of the weight and the logarithm of the fork length were calculated through the method of least squares. Two methods were used in determining the increase in length: the frequency distribution of the lengths of individuals; readings of ages on scales. A retrocalculation made it possible to determine the length of fishes at the time the last annulus was formed. Length data of fishes marked and recaptured provide a good confirmation of results obtained. Such results were compared with data from scientific literature. The growth in weight was deducted from the growth in length. The spawning migration of the striped bass takes place in autumn. They stay in the river all through the winter before they swim up to their spawning grounds in the spring. The St. Lawrence striped bass never seems to leave the river; it therefore constitutes a clearly delimited fish population.

10911. Ovchinnikov, V.V. 1966. FUNCTIONAL SIGNIFICANCE OF FINS IN XIPHIOIDAE. (Funktsional'noe znachenie plavnikov Xiphioidae). In: Ecological and morphological studies of nectonic organisms. Nauk. dumka: Kiev. 53-62. From: Ref. Zh., Biol., 1966, No. 1017. (Translation); Biological Abstracts, 49(11): Abst. No. 54863. 1968.

The fins of fishes of the families Xiphioidae (swordfish) and Histiophoridae (Atlantic sailfish, blue marlin, spearfish) differ substantially in structure and function. The four functionally specific parts of the body are provided with fins which perform the functions of anterior vertical and horizontal rudders (pectoral), keels (first dorsal) and locomotor organs (caudal, second dorsal and anal fins). Vertical turns in the sailfish, in contrast to those of the swordfish, are accomplished by bending the body laterally. During motion, the swordfish does not change the area of the dorsal fin, in contrast to the sailfish whose dorsal fin lies folded in the deep dorsal groove. The greatest dynamic stability during rectilinear motion and the greatest maneuvarability are possessed by the spearfish. In the swordfish the dynamic maneuverability remains constant both during rectilinear

motion and during turns. The less mobile fins of the swordfish do not ensure retardation during rapid motion, which is associated with a solitary mode of life in the ocean where there are virtually no obstacles. Sailfish form large schools in which the role of braking and maneuverability increases significantly. In postlarval swordfish the dorsal fin extends from the end of the gill cover to the caudal fin. Postlarval swordfishes have eel-like movements and their speeds are low. Subsequently, differentiation of the dorsal and anal fins leads to the formation of a number of functionally different fins that are characteristic of adults.

10912. Morishita, Tatsuo, Takashi Takahashi, and Shinko Tachino. 1966. STUDIES ON THE ESTERASE AND LIPASE OF FISH: II. ESTEROLYTIC ACTIVITIES OF ESTERASE AND LIPASE IN THE DIGESTIVE ORGANS FROM VARIOUS FISH. J. Fac. Fish. Prefect. Univ. Mie, 7(1): 36-45. (In Jap. with Engl. summ.); Biological Abstracts, 49(11): Abst. No. 55119. 1968.

The esterolytic activities of these enzymes in the digestive organs from various kinds of fish were measured and compared with those of the enzymes in the pancreases and livers from terrestrial animals (hog and beef). Esterase activity varied depending on the species of fish and the organs. Within a single species of fish, the activity of the liver esterase was higher than that of the esterases existing in other organs. Among the fish livers examined, the lowest activity was found in sharks and the highest activity in the eel. Eel liver hydrolyzed about 25 times as much acetate as did the shark livers, but the esterase activity level of the eel liver was only one-tenth that of the hog liver. Among the fish organs studied, the highest lipase activity was shown by the pancreas of hammer-head shark. Pancreatic lipase of this shark was only about one-ninth that of the beef in the level of the activity. When the stearate was hydrolyzed at acidic pH by the liver extract, no appreciable difference was discovered in the esterolytic activity among the materials used. (Authors)

10913. Morishita, Tatsuo, Takashi Takahashi, and Shinko Tachino. 1966. STUDIES ON THE ESTERASE AND LIPASE OF FISH: I. DISTRIBUTION OF ESTERASE AND LIPASE IN THE VISCERAL ORGANS. J. Fac. Fish. Prefect. Univ. Mie, 7(1): 27-35. Illus. (In Jap. with Engl. summ.); Biological Abstracts, 49(11): Abst. No. 55169. 1968.

The distributions of esterase and lipase in the visceral organs were investigated in the yellow tail, Seriola quinqueradiata, and rainbow trout, Salmo gairdneri irideus. Esterase activity was detected in all organs studied, and higher level of the activity was found in the liver and kidney. The esterase of each organ hydrolyzed β-naphthyl-acetate and -laurate at alkaline pH. Considerable amount of lipase which hydrolyzes β-naphthyl-stearate at alkaline pH was found in the pancreas and pyloric ceca, while much lower level of the enzyme was detected in the intestine. Activity of an enzyme that hydrolyzes β-naphthyl-stearate at acidic pH was detected in various organs except pancreas. It seems that the enzyme is a lipase which can be distinguished from pancreatic lipase. (Authors)

10914. Noda, Hiroyuki. 1966. STUDIES ON VARIOUS PHOSPHATASES OF THE FISHES: III. CHANGES IN THE ACTIVITIES OF PHOSPHATASES DURING DEVELOPMENT OF RAINBOW TROUT, Salmo irideus. J. Fac. Fish. Prefect. Univ. Mie, 7(1): 57-64. (In Jap. with Engl. summ.); Biological Abstracts, 49(11): Abst. No. 55170. 1968.

The pH values, changes in the amount of water, total N, ash and P were measured in developing rainbow trout eggs and growing young fishes of various stages. Distribution of alkaline phosphatase (Alk Pase), acid phosphatase (Ac Pase), phosphodiesterase (PDEase), pyrophosphatase (PPase), glucose-6-phosphatase (G-6-Pase) and adenosine triphosphatase (ATPase) was also investigated quantitatively according to the procedure described earlier. The amount of water increased remarkably in the fertilized eggs and swim-up fry, and total N decreased by half during the course of development, but pH value and ash content increased gradually. The total P content in the fertilized eggs increased 27% from that of unfertilized eggs. The rate of inorganic P against total P remarkably increased from the eyed

eggs to the fingerling. Alk Pase and ATPase activities in the fertilized eggs increased about twice that of unfertilized eggs. Variation in Alk Pase, Ac Pase and PPase activities during the course of development showed gradual increase with lapse of time after fertilization, Alk Pase, Ac Pase and PPase, showing high activity in the eyed eggs, continued to increase even up to the fingerling, whereas the activity of G-6-Pase was practically negligible. (Auth.)

10915. Noda, Hiroyuki. 1966. STUDIES ON VARIOUS PHOSPHATASES OF THE FISHES: IV. EFFECT OF GROWTH UPON PHOSPHATASES ACTIVITIES OF RAINBOW TROUT, Salmo irideus. J. Fac. Fish. Prefect. Univ. Mie, 7(1): 65-71. Illus. (In Jap. with Engl. summ.); Biological Abstracts, 49(11): Abst. No. 55171. 1968.

Changes in the activities of four kinds of phosphatases during the growth were studied in the organs of the rainbow trout according to the procedure described in the previous paper. These were alkaline phosphatase (abbreviated as Alk Pase), acid phosphophatase (Ac Pase), phosphodiesterase (PDEase) and glucose-6-phosphatase (G-6-Pase). Alk Pase and Ac Pase activity in the vertebral bone showed a high level in younger stages (0.5-1.7 g body weight) of the rainbow trout, and was remarkably reduced with growth. Alk Pase activity in various organs was strong in younger stages, but became lowered with age. Ac Pase slowly accumulated in various organs in younger stages, rapidly increased afterwards even up to the yearling. PDEase activity in the pyloric ceca and intestine showed a remarkable increase in the course of growth. Its activity in the kidney reached a peak in the stage 11 g in body weight, decreasing markedly thereafter. There was no significant change of PDEase activity in other organs in the course of growth. The activity of G-6-Pase in the liver of yearling increased for 3.8 times that of fingerling. (Auth.)

10916. Noda, Hiroyuki. 1966. STUDIES ON VARIOUS PHOSPHATASES OF THE FISHES: V. VARIATION IN FOUR PHOSPHATASES ACTIVITIES DURING FASTING OF RAINBOW TROUT, Salmo irideus. J. Fac. Fish. Prefect. Univ. Mie, 7(1): 73-80. Illus. (In Jap. with Engl. summ.); Biological Abstracts, 49(11): Abst. No. 55172. 1968.

The changes of various phosphatases in the rainbow trout during the fasting of 52 days were investigated with respect to alkaline phosphatase (Alk Pase), acid phosphatase (Ac Pase), phosphodiesterase (PDEase) and glucose-6-phosphatase (G-6-Pase), with the results as follows. Average body weight and fatness rapidly decreased with time during initial 9 days, a slight decrease following thereafter for experimental period of 52 days. On the 4th or 10th day after the beginning of fasting, the specific activity of Alk Pase in the kidney and intestine showed a marked decrease, which was followed by a gradual fall until the 52nd day, returning to the normal level on the 10th day after feeding. Ac Pase activity in the liver, intestine, pyloric ceca and spleen showed a marked fluctuation from the 4th day after the beginning of fasting, and about 40% of initial activity was lost in the course of 52 days, but this was not recovered to the normal level even 10 days after feeding. PDEase activity in the pyloric ceca and intestine reduced in the course of this experimental period was recovered to the initial level by feeding, but the same in the kidney, liver, stomach and spleen was in a nearly constant level during the whole course of 52 days. G-6-Pase activity of the liver extracts increased gradually for 27 days after fasting, but decreased markedly on the 52nd day. (Auth.)

10917. Almeida, L.J., E.J. Da Silva, and Yvonne M. Freitas (St. Xavier's Coll., Bombay, India). 1967. EFFECT OF ANTISEPTICS ON SOME BACTERIAL PATHOGENS OF FISH. Indian J. Microbiol., 7(1/2): 45-50; Biological Abstracts, 49(11): Abst. No. 58095. 1968.

Four antiseptics, $K_2Cr_2O_7$, $KMnO_4$ and mercurochrome, were tested against five bacterial pathogens of fish. All the antiseptics in vitro inhibited the growth of all the pathogens at $1:10^2$ dilution. Exposure of Tilapia mossambica to $1:10^2$ dilution of $KMnO_4$, for 1-2 minutes proved fatal. Swabbing the skin lesions produced by Alcaligenes faecalis with $1:10^4$ dilution of $KMnO_4$ proved effective in the early stages of the disease. (Authors)

10918. Almeida, L. J., E. J. Da Silva, and Yvonne M. Freitas (St. Xavier's Coll., Bombay, India). 1967. EFFECT OF ANTIBIOTICS ON SOME BACTERIAL PATHOGENS OF FISH. Indian J. Microbiol., 7(1/2): 51-56; Biological Abstracts, 49(11): Abst. No. 58096. 1968.

Penicillin G, Terramycin (oxytetracycline) streptomycin, Chloromycetin (chloramphenicol), and Aureomycin (chlortetracycline) were tested in vitro and in vivo against five bacterial pathogens of fish. Chloromycetin was effective against Aeromonas salmonicida and Aeromonas hydrophila in vivo. (Authors)

10919. Hellier, Thomas R., Jr. (Dept. biol., Arlington State College, Arlington, Texas). 1967. THE FISHES OF THE SANTA FE RIVER SYSTEM. Bull. Fla. State Mus. Biol. Sci., 11(1): 1-46. Illus. Map; Biological Abstracts, 49(11): Abst. No. 59534. 1968.

This paper correlates the fish populations of the Santa Fe River (Florida) with such physical aspects as its underground channel, substantial subterranean drainage, and low chlorinity. Recorded from the river and its tributaries are 60 species of fishes representing 21 families and 13 orders. Pertinent life history notes are given for many of the species, including one species nearly endemic to the river, Micropterus notius. The derivation of the ichthyofauna is suggested; 25 species comprise an element widespread to the north, 18 to the southeast; 8 species are typically Floridian, and 8 species are from marine waters. Eurhyaline species in the Santa Fe are generally restricted to the portion of the river downstream from the underground channel. A new term is proposed, dihaline, to describe those species that maintain breeding populations in both fresh and marine waters. (Auth.)

10920. Suzuki, Ryo, and Teiichi Kato. 1966. HYBRIDIZATION IN NATURE BETWEEN SALMONID FISHES, Salvelinus pluvius X Salvelinus fontinalis. Freshwater Fishers. Res. Lab. Bull., 16(2): 83-90. Illus.; Biological Abstracts, 49(12): Abst. No. 59890. 1968.

Six specimens of the natural hybrids between S. pluvius and S. fontinalis were collected from a brook flowing into Lake Chuzneji. They were estimated to constitute about 11.8% of the population of parental species at the area of headspring. Hybrids displayed a certain intermediacy between parental species in color marking. In meristic characters, they did not show exact intermediate, but their many measurements fell between the averages for those of the parental species. These characters of natural hybrids were almost similar to those of F_1 hybrids produced artificially from S. pluvius female X S. fontinalis male, except that there was a little difference. (Authors)

10921. Konstantinov, A. S. 1959. THE FOOD OF CHIRONOMID LARVAE AND SOME WAYS OF INCREASING THE FOOD PRODUCTION OF RESERVOIRS. (Pitanie lichinok khironomid i nekotorye puti povysheniya kormnosti vodoemov). In: Proceedings of the Sixth Conference on the Biological Problems of Inland Waters, 1957. Akad. Nauk SSSR: Moscow-Leningrad. 260-269; Ref. Zh., Biol., 1960, No. 71248. (Translation); Biological Abstracts, 49(12): Abst. No. 60267. 1968.

Chironomid larvae can be grouped according to their manner of feeding, into predatory--feeding on members of their own family and other small animals, and omnivorous--feeding on detritus, bacteria, algae, higher water plants, and to some degree, animals. The division of omnivorous larvae may be divided into three groups: benthophages--free-living larvae gathering their food from the bottom surface, sedimentators--larvae living in holes and feeding on organic particles which stick to threads which they secrete, and filtrators--larvae which build tubes or which mine higher aquatic plants or wood and utilize minute organic particles suspended in the water which passes through the tubes. Filtrators have not lost the ability of feeding in the same manner as benthophages and sedimentator larvae; for this reason filtrators show selectivity not only in connection with the composition of the food itself, but also with the manner of feeding. Both the predatory and omnivorous larvae can feed to excess. When deciding on how to increase the food production of a reservoir, the following facts should be considered:

chironomid larvae avoid the blue-green algae and feed only on whatever is available to them in a thin layer covering the bottom of the reservoir; occasionally filtration and sedimentation are disturbed and sometimes even stopped when rough mineral particles suspended in the water are numerous; the omnivorous larvae may be eaten by predators. Therefore to increase the food content of reservoirs, the development of green algae should be encouraged and that of blue-green algae suppressed. Measures should be taken to prevent muddiness of the water; organic substances should be introduced into the reservoir as additional food for the larvae; it may be spread on the surface of the water. --Courtesy NSF (PL 83-480) 1963.

10922. Zaika, M. S., and M. I. Zozulina. 1966. EFFECT OF SOWING CEREAL GRAINS IN INCREASING THE PRODUCTION OF DON POND FISH ESTABLISHMENTS. (Vliyanie posevov zlakovykh kul'tur na uvelichenie produktivnosti vodoemov donskikh nerestovo-vyrastnykh khozyaistv). Tr. Azov. Nauch Issled Inst. Rybn. Khoz, 8. 141-150. From: Ref. Zh., Biol., 1966, No. 12I186. (Translation); Biological Abstracts, 49(12): Abst. No. 60353. 1968.

To control weed growth, the fish ponds were seeded with winter rye and wheat. After the ponds were filled in March-April, the seeds grew for some time and died in May-June. Wheat that was only partly submerged died later. Crops of winter grains were found to inhibit the growth of dense weeds to a certain extent in the first year and almost completely in the third. The agrobiological measures enriched the natural food supply. Fish productivity rose from 77 to 273 kg/ha.

10923. Fee, Everett (Iowa Agr. and Home Econ. Exp. Sta., Ames, Iowa). 1967. LIFE HISTORY OF THE NORTHERN COMMON SHINER, Notropis cornutus frontalis, IN BOONE COUNTY, IOWA. Proc. Iowa Acad. Sci., 72: 272-281; Biological Abstracts, 49(12): Abst. No. 64983. 1968.

N. c. frontalis was omnivorous in its feeding, but the type of food utilized was greatly influenced by water levels. Reproduction was later in Squaw Creek than in the Des Moines River. Males had consistently higher condition factors than females. Fish grew faster in Squaw Creek than in the Des Moines River but failed to reach the length of the Des Moines River fish in their first year because of a later spawning period. Myxosporidians, nematodes, tapeworms, and copepods parasitized this species. (Auth.)

10924. Noble, Richard L. (Iowa State Univ., Dept. Zool. and Entomol., Ames, Iowa). 1967. LIFE HISTORY AND ECOLOGY OF WESTERN BLACKNOSE DACE, BOONE COUNTY, IOWA, 1963-1964. Proc. Iowa Acad. Sci., 72: 282-292; Biological Abstracts, 49(12): Abst. No. 64988. 1968.

A life history and ecology study of the western blacknose dace, Rhinichthys atratulus meleagris (Agassiz), was made on Elkhorn and Pease Creeks, Boone County, Iowa. Total length equals 1.23 standard length; live length equals 1.03 preserved length; and live weight equals 0.90 preserved weight. Dace reached maturity at age II. Spawning occurred from early May through July over gravel. Number of eggs increased with length of females. Scale formation proceeded forward from the caudal peduncle at 16-20 mm standard length. Scale growth was not directly proportional to body growth. Annuli formed between March and May. Fish which lacked scales until spring of the second year lacked a first annulus. Fastest growth occurred during May, June and July for age I and II dace. Age 0 fish reach an average of 24-27 mm in length during their first year. Age I fish reach 49-50 mm. Few fish reach age III. Length-weight relationships differed significantly between sexes and populations. Diptera larvae were the only consistently utilized food item. Predation by creek chubs occurred. Up to 100 nematodes of the genus Rhabdochona per dace were found with no apparent harmful effects. Although dace overwintered in pools of both streams, some moved into the Des Moines River. During summer, dace concentrated in cool headwaters. (Auth.)

10925. Dufour, D., and D. Barrette (Cent. Bioedecine, Univ. Laval, Que., Canada). 1967. POLYMORPHISM IN SERUM LIPOPROTEINS AND GLYCOPROTEINS IN TROUT. (Polymorphisme des lipoproteines et des glycoproteines seriques chez la Truite). Experientia, 23(11): 955-959. Illus. (Engl. Summ.); Biological Abstracts, 49(13): Abst. No. 65610. 1968.

Important differences among the serum proteins of three different species of trout (Salmo trutta, Salvelinus fontinalis, Salmo gairdneri) were found using immunoelectrophoresis with rabbit antibody. These genetic variations concern the lipoproteins as well as the glycoproteins. Furthermore, three serum proteins of Esox lucius have antigenic determinants common with the serum proteins of S. gairdneri; they are an α_2-lipoprotein, an α_2-glycoprotein and a gamma-globulin. (Authors)

10926. Vik, Rolf (Zool. Museum, Sars gatel, Oslo, Norway). 1967. Diphyllobothrium CONTROL. (Makemark-kontroll). Fauna (Oslo), 20(2): 88-95. Illus.; Biological Abstracts, 49(13): Abst. No. 69877. 1968.

Because of the deleterious effect Diphyllobothrium novegicum infection had on the trout fishing industry in a lake in Norway, a campaign was undertaken in 1949 to exterminate the most likely final host, the common gull (Larus canus), by destroying all eggs and young each summer. In 1950, 57% of trout samples from the lake were infected at an intensity averaging 27 plerocercoids per fish for the total population. By 1951 the breeding population of gulls was virtually eliminated and remained so through 1964, at which time the incidence of infection in the trout had dropped to 4.5% and the intensity to 0.2 larvae per fish. (Auth.)

10927. Fredrickson, Leigh H., and Martin J. Ulmer. 1967. CARYOPHYLLAEID CESTODES FROM TWO SPECIES OF REDHORSE (Moxostoma). Proc. Iowa Acad. Sci., 72. 444-461. Illus.; Biological Abstracts, 49(13): Abst. No. 69988. 1968.

Two caryophyllaeid tapeworms, Isoglaridacris longus sp. n., and I. folius sp. n., are described from two species of redhorse, namely, Moxostoma macolepidotum and M. erythrurum, respectively. Members of the genus Isoglaridacris appear to be host specific, since the two species mentioned in this study occur in different fish hosts collected from the same rivers. Both I. longus and I. folius appear to exhibit seasonal periodicity, the smallest populations occurring in late summer. Their presence or absence in fish during the winter months, however, is unknown. Infected fish usually harbor a small number of cestodes, generally only a single worm. The annual percent of infection is 38% for the northern redhorse and 37% for the golden redhorse. Eggs are operculate and oncospheres show well-defined hooks after 17 days. A key to the three known species of the genus Isoglaridacris is presented. (Authors)

10928. Great Lakes Fisheries Commission (1451 Green Road, Ann Arbor, Mich.). 1967. ANNUAL REPORT FOR THE YEAR 1966. Great Lakes Fish. Comm. Ann. Rept. 1966. 1-61; Biological Abstracts, 49(14): Abst. No. 70503. 1968.

This report commences with a brief introduction dealing with the history and purpose of the Commission. The proceedings of the annual meeting are given. Also included are original papers on lamprey control and a summary of trout and salmon plantings.

10929. International Council for the Exploration of the Sea. (Charlottenlund Slot, Charlottenlund, Denmark). 1967. REPORT OF THE ICES-ICNAF JOINT WORKING PARTY ON NORTH ATLANTIC SALMON, 1966. Int. Counc. Explor. Sea Coop. Res. Rept. Ser. A 8. 1-27; Biological Abstracts, 49(14): Abst. No. 70505. 1968.

The state of the stocks of Atlantic salmon and the effects on the Greenland fishery was studied.

10930. Foye, Robert E., Charles F. Ritzi, and Roger P. AuClair. 1969. FISH MANAGEMENT IN THE KENNEBEC RIVER. Maine Dept. of Inland Fisheries and Game, Fisheries Research Bulletin No. 8. 67 p. Illus.

10931. Clark, John (Sandy Hook Marine Lab., Highlands, N.J.). 1967. FISH AND MAN: CONFLICT IN THE ATLANTIC ESTUARIES. American Littoral Society Special Publication No. 5. vi + 78 p. Illus. Pr. $1. American Littoral Society, Highlands, N.J.

Twenty-one estuarine-dependent Atlantic game and commercial fishes are listed; 5 are discussed in detail. Shoreline projects such as land fill, navigation projects, gravel and sand mining, mosquito control and marsh impoundment, highway construction, and water control are discussed in relation to the destruction or disruption of the original marsh and other tidal habitat of fish and shellfish. A brief review of estuarine exploitation and conservation is given for each of the 14 states along the Atlantic coast, using published reports and solicited comments from conservation agencies. A 68 item reference list is appended.

10932. Libosvarsky, Jiri (Inst. Vertebrate Zool., Czech. Acad. Sci., Brno, Czech.). 1967. THE EFFECT OF FISH IRRITATION BY ELECTROFISHING ON THE POPULATION ESTIMATE. Ekol. Pol. Ser. A, 15(4): 91-106. Illus.; Biological Abstracts, 49(14): Abst. No. 71010. 1968.

Using chub, Leuciscus cephalus, experiments were carried out in a natural stream which aimed at showing the effects of decreased vulnerability of the fish, caused by repeated application of the shocker, on the probability of capture and the population estimate. When using the removal method on the indigenous fish populations, with the probability of capture varying between 0.50 to 0.65, a reasonably precise population estimate can be obtained. An underestimation may occur in fishing with a high probability of capture. Under some assumptions, three consecutive fishings give satisfactory estimation.

10933. Kussat, R.H. (Dept. of Fisheries of Canada, Vancouver, B.C., Canada). 1969. A COMPARISON OF AQUATIC COMMUNITIES IN THE BOW RIVER ABOVE AND BELOW SOURCES OF DOMESTIC AND INDUSTRIAL WASTES FROM THE CITY OF CALGARY. Can. Fish Cult., 40: 3-31.

A general biological survey was conducted on two backwaters of the Bow River, one above, the other below the heavier outfall of industrial and domestic wastes from the city of Calgary. Analyses of biological and chemical data indicated the following changes in the environment had taken place: reductions in numbers of invertebrate genera comprising the bottom fauna, increased coefficients of condition of Catostomus commersoni and of C. catostomus taken at the downstream locality, and differences in dissolved oxygen, nitrogen and phosphate concentrations. Further, preliminary parasitological surveys indicating reduced incidence and number of certain internal parasites suggest that the intermediate hosts were unable to survive in the more heavily polluted reach of the Bow River. The results of this survey strongly suggest that industrial and domestic effluents discharged into the river are responsible for the differences observed in the study sites upstream and downstream from Calgary. (Auth.)

10934. Rosen, Lawrence, and G. David Novelli (Biol. Div., Oak Ridge Natl. Lab., Oak Ridge, Tenn.). 1967. RIBONUCLEASE-RESISTANT INCORPORATION OF PHENYLALANINE INTO PROTEIN BY A SOLUBLE SYSTEM FROM TROUT LIVER. Biochim. Biophys. Acta, 145(1): 218-220. Illus.; Biological Abstracts, 49(14): Abst. No. 71578. 1968.

A soluble protein preparation that incorporates phenylalanine into protein is discussed. (From auth.)

10935. Banner, Arnold (Inst. Mar. Sci., Univ. Miami, Miami, Fla.). 1967. EVIDENCE OF SENSITIVITY TO ACOUSTIC DISPLACEMENTS IN THE LEMON SHARK, Negaprion brevirostris (Poey). In: Lateral line detectors. Proc. of a symposium. 16-18 April 1966. New York. Indiana University Press: Bloomington, Indiana and London. 265-273. Illus.; Biological Abstracts, 49(14): Abst. No. 72354. 1968.

Young lemon sharks respond either to acoustic displacements or to associated functions at frequencies between 20 and 1000 cps. This alone does not eliminate the possibility of sensitivity to acoustic pressures. The displacement thresholds

presented are representative to signal-to-noise sensitivity and probably are not indicative of absolute sensory thresholds. Future marine bioacoustic studies should record sound intensities as displacements as well as pressures. (Auth.)

10936. Timoshina, L. A. (State Res. Inst. Lake River Fish., Leningrad, USSR). 1967. AMINO ACIDS OF THE RAINBOW TROUT EMBRYO. Vop. Ikhtiol., 7(4): 626-632. Illus.; Biological Abstracts, 49(14): Abst. No. 73478. 1968.

Paper chromatographic determinations were made of the free and bound amino acids contained in rainbow trout embryos at various stages of development. The composition of the bound amino acids varied slightly in quality and more substantially in quantity. As the roe of the trout develop, the total amount of bound amino acids increases; after hatching, there is a slight decrease. The free amino acid composition also varied in both respects; the free amino acid concentration decreased with development of the roe and increased slightly after the embryos emerged. An analysis of bright and pale roe showed no important difference between the amino acid concentrations in the two types of roe; their chromatograms were identical. (Auth. summ. transl.)

10937. Swabey, Yvonne H., C. F. Schenk, and G. L. Parker (Ont. Water Res. Comm., Toronto, Ont., Canada). 1967. EVALUATION OF TWO ORGANOPHOSPHORUS COMPOUNDS AS BLACKFLY LARVICIDES. Mosquito News, 27(2): 149-155; Biological Abstracts, 49(14): Abst. No. 75221. 1968.

Applications of Abate 4E (0, 0, 0'-tetramethyl 0, 0'-thiodi-p-phenylene phosphorothioate; American Cyanamid) and Baytex (0, 0-dimethyl 0-[4-(methylthio)-m-tolyl] phosphorothioate; Chemagro Corporation) were made to several streams in Ontario to determine their suitability as replacements for DDT as a blackfly larvicide. Abate at 0.05 ppm active for 30 minutes eliminated larvae for 1,000 yards and at 0.15 ppm for 1,450 yards, without apparent toxic effects on other resident fauna. Baytex was less efficacious at equivalent concentrations but eliminated larvae for at least 350 yards at a rate of 0.5 ppm. Laboratory bioassays on Abate yielded median tolerance limits of 6.2 ppm active for minnows (Pimephales promelas), 4.9 ppm for crayfish (Orconectes virilis) and 0.56 ppm for stonefly nymph (Togoperla media). Speckled trout (Salvelinus fontinalis) survived exposure to 2 ppm for 24 hours. Minnows and stoneflies exposed to 10 ppm active Abate for 30 minutes and crayfish exposed to 18 ppm were visibly affected but all individuals recovered following transfer to clean water and appeared to be normal 24 hours later. (Authors)

10938. Becker, C. Dale (Fisheries Res. Inst., College of Fisheries, Univ. of Washington, Seattle, Wash.). 1967. THE PARASITIC FAUNA OF TELEOSTS IN SIX WASHINGTON LAKES [protozoa, helminths, Acarina]. Northwest Sci., 41(4): 160-168; Biological Abstracts, 49(14): Abst. No. 75265. 1968.

10939. Price, Charles E., and Thomas E. McMahon (Augusta College, Augusta, Ga.). 1967. THE MONOGENETIC TREMATODES OF NORTH AMERICAN FRESHWATER FISHES. Riv. Parassitol., 28(3): 177-220. Illus.; Biological Abstracts, 49(14): Abst. No. 75335. 1968.

A one-reference account of the monogenetic trematodes of North America has been needed for quite some time. These topics are treated in this monograph: the taxonomic literature of the Monogenea, a general account of the order Monogenea, keys to the various taxa treated, generic diagnoses, taxonomic notes on each of the genera, an anatomical account of a "generalized" freshwater monogenean, materials and methods involved, notes on host-specificity, suggestions for preparing morphological descriptions, host-parasite listing of North American species, notes on exotic species reported in North American literature, a list of synonyms in the North American literature and a comprehensive reference section.

10940. Carlson, Dale R. (Worthington State Junior Coll., Worthington, Minn.). 1966. AGE AND GROWTH OF THE STONECAT, Noturus flavus Rafinesque, IN THE VERMILLION RIVER. Proc. S. Dak. Acad. Sci., 45: 131-137; Biological Abstracts, 49(14): Abst. No. 75710. 1968.

10941. Godsil, Patrick J., and William C. Johnson (Klamath Basin Study, Fed. Water Pollut. Contr. Admin., Klamath Falls, Oreg.). 1968. RESIDUES IN FISH, WILDLIFE, AND ESTUARIES. PESTICIDE MONITORING OF THE AQUATIC BIOTA AT THE TULE LAKE NATIONAL WILDLIFE REFUGE. Pestic. Monit. J., 1(4): 21-26. Illus. Map; Biological Abstracts, 49(15): Abst. No. 78481. 1968.

Because of pesticide poisoning of fish-eating birds, the Federal Water Pollution Control Administration established a water quality monitoring program at the Tule Lake and Lower Klamath Lake Wildlife Refuges in 1964. Over a 2-year period, samples of water, suspended material, submerged aquatic plants, clams, and fish were collected and analyzed for chlorinated hydrocarbon pesticides. Results are reported from a typical station in the Tule Lake National Wildlife Refuge. Compounds DDE, DDD, DDT, chlordane, and endrin were found regularly in samples of both water and biota. Water contained a maximum of 0.10 ppb of endrin in 1965, while tui chubs, Siphateles bicolor, accumulated a maximum of 198 ppb during the same year. Concentrations of endrin in the other strata of the biota were distributed between these extremes of the food chain. The occurrence of endrin was directly associated with contaminated irrigation return water supplying the Refuge lakes. as the concentrations of studied pesticides increased in the drainage water, the biota also became contaminated. However, at the end of the season, as the concentrations in both water and biota returned to or near analytical sensitivity (water — 0.007 ppb; biota— 4 ppb) between growing seasons.

10942. Moubry, R.J., J.M. Helm, and G.R. Myrdal (Wis. Dept. Agr., Gen. Lab. Div., Madison, Wis.). 1968. CHLORINATED PESTICIDE RESIDUES IN AN AQUATIC ENVIRONMENT LOCATED ADJACENT TO A COMMERCIAL ORCHARD. Pestic. Monit. J., 1(4): 27-29; Biological Abstracts, 49(16): Abst. No. 81873. 1968.

Samples of water, silt, bottom organic debris, bottom organisms, and fish were collected from an aquatic environment located adjacent to a commercial orchard. Residue data obtained from the analysis of these samples are presented. The results obtained indicate that contamination of the environment studied was minimal. (Authors)

10943. Coon, Kenneth L., Alfred Larsen, and James E. Ellis (Comm. Catfish Culturist, P.O. Box 476, Tuckerman, Ark.). 1968. MECHANIZED HAUL SEINE FOR USE IN FARM PONDS. Fish. Ind. Res., 4(2): 91-108. Illus.; Biological Abstracts, 49(16): Abst. No. 81882. 1968.

Present methods of harvesting fish from farm ponds are time consuming, laborious, and wasteful of water. This paper supplies information on a mechanized system in which a haul seine and associated equipment are used to capture fish in farm ponds and a conveyor and associated equipment are used to load and weigh the fish into trucks for shipment to market. The mechanized seine works well both in ponds of small or large size and water as deep as 8 feet.

10944. Hayashi, Koichiro, N.W. Green, and Edgar C. Black (Summerland Trout Hatchery, Summerland, B.C., Canada). 1964. CARBOHYDRATE METABOLISM DURING TRANSPORTATION OF LIVE RAINBOW TROUT, Salmo gairdneri. Prefect. Univ. Mie Rep. Fac. Fish., 5(1): 51-125. Illus.; Biological Abstracts, 49(16): Abst. No. 81890. 1968.

Certain changes in carbohydrate metabolism during handling and transportation of live rainbow trout, S. gairdneri was studied. Blood and muscle lactate, and muscle and liver glycogen were used as indicators of muscular activity and degree of starvation. Observations were also made on behavior and mortality. Procedures investigated were: air-dipping and water-brailing, weighing and transferring, loading and subsequent sham transportation in a hatchery tank truck, various methods of supplying air and/or O_2 during the sham run, and the use of the sedative drug Avertin (tribromoethanol and amylene hydrate). These studies were carried out at the Summerland Trout Hatchery, Summerland, B.C., Canada. Based on lactate response, even minimal handling caused significant increase in muscular activity for rainbow trout. Starvation prior to transportation was associated with a reduction of muscle and liver glycogen. Mortalities occurred, but these were

associated with a reduced O_2 supply, not with increased lactate. Use of Avertin did not appear to alter the pattern of carbohydrate changes during transportation. Significance of the results in relation to trout hatchery practice are discussed. (Authors)

10945. Moriarty, C. (Dept. Agr. and Fish., Dublin, Ireland). 1968. MOVEMENTS OF SALMON AROUND IRELAND. X. FROM THE NORTH MAYO COAST (1962-1964). Proc. Roy. Irish Acad. Sect. B. Biol. Geol. Chem. Sci., 66(1): 1-7. Maps; Biological Abstracts, 49(16): Abst. No. 81901. 1968.

Salmon numbering 542 captured at sea by drift nets were tagged in the months of June and July 1962, 1963 and 1964. Seventy-two tags (13.3%) were recovered. The fish dispersed widely around the Irish coast and recoveries were made also from Wales (2), Scotland (1) and Sweden (1). Migrations at speeds of over 60 km per day were recorded.

10946. Petrenko, V.P., and D.R. Sadykhov. 1966. THE DYNAMICS OF FREE AMINO ACIDS IN THE BLOOD SERUM, LIVER AND MUSCLES OF 2-SUMMER CARP IN RELATION TO NUTRITIONAL PROTEIN QUALITY. (Dinamika svobodnykh aminokislot syvorotki krovi, pecheni i myshts dvukletkov karpa v svyazi s razlichnoi pitatel'noi tsennost'yu). In: Report Summaries of the All-Union Conf. on the Ecology and Physiology of Fishes, 1966. Moscow. 72. From: Ref. Zh., Biol., 1967, No. 2I111. (Translation); Biological Abstracts, 49(16): Abst. No. 82194. 1968.

The dynamics of free amino acids were determined in carp fed diets balanced and unbalanced with respect to methionine and lysine. A relation was established between the quality of nutritional protein and the amount of blood plasma amino acids; the proportions of amino acids in blood serum, liver and muscles were determined. A relationship between the amount of free amino acids and growth rate was demonstrated.

10947. Rieske, John S. (Sch. Med., Ohio State Univ., Columbus, Ohio). 1968. ANTIMYCIN A. In: Antibiotics. Vol. I: Mechamism of action. Springer-Verlag, Inc.: New York. 542-584. Illus.; Biological Abstracts, 49(16): Abst. No. 85490. 1968.

Antimycin A, an antibiotic complex produced by several species of Streptomyces, consists of at least four components of closely related structure. The antimycins are extremely toxic toward a number of phytopathogenic fungi; they also exhibit toxic action toward higher organisms and have potential commercial use as a fish poison for the removal of undesirable fish from lakes and ponds. Antimycin A is a potent inhibitor of the respiratory chain; this review discusses the toxicology of the compound, its effect on mitochondrial electron transport, photosynthesis, the hepatic aldehyde oxidase system, and the chemical characteristics of Antimycin A in relation to its inhibitory activity. Experiments attempting to elucidate the site of action of antimycin are presented. Tables include the types and microbiological sources of Antimycin A, the fungi inhibited strongly by the antimycins, the toxicity of Antimycin A toward higher animals (insects, fish, birds, mammals), the enzyme systems inhibited by Antimycin A, and the inhibitory activity of derivatives and synthetic analogs of Antimycin A. There is a bibliography with 138 references. (From auth.)

10948. Soltynska, Maria (Protozool. Lab., Univ. Warsaw, Warsaw, Poland). 1967. MYXOSPORIDIA OF FISHES FROM THE ZEGRZE LAKE [POLAND] Acta Protzol., 4(25/35): 307-325. Illus. (Pol. summ.); Biological Abstracts, 49(16): Abst. No. 86360. 1968.

The article contains the description of 14 species of Myxosporidia of the genera: Myxosoma, Myxobolus, Henneguya and Thelohanellus which are gill parasites of 9 species of fishes from Zegrze Lake near Warsaw. In almost all the species, the range of variability was found to be greater than has been recorded. Attention was paid to sporoblast features which may serve as diagnostic characters. In most of the species studied, the presence of 2 types of anomalous spores was

recorded: anomalies of shape; developmental anomalies characterized by an increased or diminished number of polar capsules than is typical for the given species. (Auth.)

10949. Greenwood, P. Humphry (British Mus., (Nat. Hist.), London, England). 1967. BLIND CAVE FISHES. Stud. Speleol., 1(5): 262-274. Illus.; Biological Abstracts, 49(16): Abst. No. 86638. 1968.

This article attempts broadly to review the natural history of freshwater cave fishes, and to consider their anatomical and physiological peculiarities in relation to cave habitats. There is considerable variation in the extent to which the eyes are reduced in cave fishes, but a fairly marked degree of optical degeneration is usual. Loss or reduction of pigments is another common characteristic of these animals. Thirty-two cave-dwelling fish species are known, and most continents have at least one species. Europe and Britain are exceptional in being without fishes which spend their entire lives in caves. By far the greatest number of species occurs in the New and Old World tropics. Divergent views are held on the way in which cave species have evolved, and the question is still far from settled. Results of research on growth rates appear contradictory, and a rather paradoxical situation is presented by some recent research on the stresses of living in total darkness. These various factors are discussed, and attention is drawn to the many parallels existing between cave fishes and fishes living in the deeper levels of the sea. The bibliography should provide an adequate introduction to the major papers on cave fish biology. (Auth.)

10950. Moreland, John M. 1967. MARINE FISHES OF NEW ZEALAND. 56 p. Illus. A.H. and A.W. Reed: Wellington, N.Z. and Sydney, N.S.W. Australia. Pr. $2.25; Biological Abstracts, 49(16): Abst. No. 86642. 1968.

This book is a scientifically oriented color atlas of every sea fish likely to be found in New Zealand waters. Each species is presented with its common name and scientific name, a list of habitats and salient characteristics, diet, and methods of catching. A subject index is included.

10951. Armstrong, Robert H., and Wm. Markham Morton. 1969. REVISED ANNOTATED BIBLIOGRAPHY ON THE DOLLY VARDEN CHAR. Alaska Dept. of Fish and Game Research Report No. 7. 108 p.

This revised bibliography contains 507 published and unpublished references on the Dolly Varden, Salvelinus malma (Walbaum).

10952. Linn, Jack D., and Ronald L. Stanley (Calif. Dept. Fish and Game, Sacramento, Calif.). 1969. TDE RESIDUES IN CLEAR LAKE ANIMALS. Calif. Fish and Game, 55(3): 164-178. Illus.

A cooperative program to monitor the levels of TDE residues in Clear Lake fauna was conducted from 1959 through 1965. Eight species of fishes and four species of birds were collected for residue analysis, though primary emphasis was on largemouth bass and white catfish. Residues of TDE varied considerably among individual animals, but the general level of contamination in birds and fish declined from the high levels reported in 1958 to much lower levels in 1963 and 1965. (Authors)

10953. Dailey, Murray D. (Dept. Biology, Calif. State College at Long Beach, Long Beach, Calif.). 1969. A SURVEY OF HELMINTH PARASITES IN THE SQUID, Loligo opalescens, SMELT, Osmerus mordax, JACK MACKEREL, Trachurus symmetricus, AND PACIFIC MACKEREL, Scomber japonicus. Calif. Fish and Game, 55(3): 221-226.

One hundred and one specimens of squid, smelt, jack mackerel, and Pacific mackerel were examined for larval and adult helminth parasites. Infection rates were 8.0%, 76.9%, 84.0% and 92.0% in the smelt, squid, Pacific mackerel, and jack mackerel, respectively. Parasites recovered represented classes Cestoda, Trematods, and Nematoda, and the phylum Acanthocephala. (Auth.)

10954. Lister, D. Brent, and Richard A. L. Harvey (Resource Development Branch, Dept. of Fisheries of Canada, Vancouver, B. C., Canada). 1969. LOSS OF PETERSEN DISK TAGS FROM SPAWNING CHUM SALMON (Oncorhynchus keta). Can. Fish Cult., 40: 33-40.

Petersen disk tag loss from spawning chum salmon was studied over a three-year period in an artificial spawning channel. The time from tagging to recovery averaged approximately 11 days. Accurate enumeration of fish entering the channel and virtually complete recovery of dead on completion of spawning enabled estimation of tag loss on the basis of changes in the tagged:untagged ratio over the spawning period. The average rate of tag loss from males (30%) was significantly higher than the loss from females (9%). Loss among males was also related to date of entry into the channel, with tags applied early in the run having a greater chance of loss than those applied late in the run. The addition of accessory buffer disks to the tag reduced loss by 50%, thus indicating that disk failure was the primary factor responsible. (Authors)

10955. Fraser, F. J., and T. G. Halsey (Dept. of Fisheries of Canada, Vancouver, B. C., Canada). 1969. THE APPLICATION OF AN AIR-PERCOLATION SYSTEM FOR WATER TEMPERATURE REDUCTION IN ROBERTSON CREEK. Can. Fish Cult., 40: 41-49.

High-water temperatures have been a principal factor in limiting the success of the Robertson Creek Spawning Channel. To alleviate this problem two air percolation systems were used. The upwelling of cold water induced by these systems significantly altered the temperature profiles of the head waters, Boot Lagoon and Great Central Lake. The surface water temperature of Boot Lagoon was reduced 6.5° F after three days of percolation. Concomitantly, the water temperature in Robertson Creek dropped 6.0° F. One-half of this decline was probably caused by percolation, while the remainder was due to a drop in air temperature. Inflowing warm water from Great Central Lake at the time of the experiment reduced the extent of temperature reduction in Boot Lagoon and Robertson Creek. (Authors)

10956. Walker, C. E., J. Alex Wood and Ian A. Maclean (Resource Development Branch, Dept. of Fisheries of Canada, Vancouver, B. C., Canada). 1969. A CONVERGING THROAT TRAP FOR SAMPLING JUVENILE SALMONIDS. Can. Fish Cult., 40: 51-56.

A converging throat trapping system is described which provides a sample of downstream migrating juvenile salmon. The traps have been operated from a counting fence to enumerate newly emerged sockeye salmon fry. They have fishes successfully in depths to four feet and velocities up to six feet per second with no observed mortalities to the captured fish. (Authors)

10957. Lister, D. Brent, Richard A. L. Harvey, and C. E. Walker (Resource Development Branch, Dept. of Fisheries of Canada, Vancouver, B. C., Canada). 1969. A MODIFIED WOLF TRAP FOR DOWNSTREAM MIGRANT YOUNG FISH ENUMERATION. Can. Fish Cult., 40: 57-60.

An inclined screen trapping system is described which provides a sample of downstream fish migrations by screening a portion of the stream flow. The traps have been used to enumerate four species of juvenile migrant salmonids, ranging in size from emergent chum salmon fry (Oncorhynchus keta) to two-year-old steelhead trout smolts (Salmo gairdneri). (Authors)

10958. Hatfield, C. T. (Resource Development Branch, Dept. of Fisheries of Canada, St. John's Newfoundland, Canada). 1969. EFFECTS OF DDT LARVICIDING ON AQUATIC FAUNA OF BOBBY'S BROOK, LABRADOR. Can. Fish Cult., 40: 61-72.

Effects of a DDT larviciding program on aquatic fauna in a tributary stream of the Alexis River, Labrador, were determined. Effects on fish were measured by holding trout (Salvelinus fontinalis) in cages located at six stations along the brook. Bottom invertebrate counts were taken every third day in plots at five of these stations. Drifting insects in the stream were sampled using one foot square fyke

nets before, during and after DDT larviciding near each station. Water, mud and fish samples were collected for DDT content analysis by gas chromatography. One untreated station was used as a control. Water was also sampled for general chemistry. No significant mortalities occurred in the caged fish, but many dead wild fish were collected with DDT content readings of their tissue ten times those of fish caught before larviciding began. DDT content of wild fish caught alive increased with time. Bottom invertebrates were sharply reduced as a result of DDT larviciding at all treated stations. Caddisfly larvae were most affected. Drifting insect larvae in the stream increased exponentially during each DDT application. General chemistry of water in the brook was unchanged by larviciding. (Auth.)

10959. Ducharme, L. J. Andre (Resource Development Branch, Dept. of Fisheries, Halifax, N. S. Canada). 1969. AN IMPROVED DIP NET FOR USE IN ELECTRO-FISHING. Can. Fish Cult., 40: 73-76.

A new dip net for the capture of small fish, stunned by D. C. electro-fishing, is described. The net is for use in shallow riffles only. Undesirable interference with the electrical field around the anode by the original metal dip net is eliminated by the use of non-conductive materials. The new net is light and safe to use. Detailed drawing and photograph are included. (Auth.)

10960. Tsai, Chu-fa, and Robert B. Zeisel (Univ. of Maryland, College Park, Md.). 1969. NATURAL HYBRIDIZATION OF CYPRINID FISHES IN LITTLE PATUXENT RIVER, MARYLAND. Chesapeake Sci., 10(2): 69-74.

Three natural combinations of cyprinid hybrids were found in the Little Patuxent River, Maryland in the vicinity of the Fall Line. They resulted from the spawning of Notropis cornutus, Notropis rubellus and Clinostomus funduloides over the nests of Nocomis micropogon. The hybrid N. rubellus X C. funduloides was an unreported hybrid combination. It was rare; its characteristics were intermediate between the parental species. The hybrid N. cornutus X N. rebellus was common while N. cornutus X C. funduloides occurred rarely. The particular ecology, including the high stream gradient and generally sandy bottom with boulders and bedrock, appeared to contribute to the hybridization. The rarity of hybrids involving C. funduloides is attributed to the greater genetic isolation. There appeared to be no relationship between the frequency of hybridization and the distance between the precise positions of the parental species as they spawned over the Nocomis nest. (Authors)

10961. Dovel, W. L., J. A. Mihursky, and A. J. McErlean (Natural Resources Inst., Univ. of Maryland, Solomons, Md.). 1969. LIFE HISTORY ASPECTS OF THE HOGCHOKER, Trinectes maculatus, IN THE PATUXENT RIVER ESTUARY, MARYLAND. Chesapeake Sci., 10(2): 104-119.

Information is presented on the abundance, distribution and seasonality of hogchoker life history stages in the Patuxent River Estuary. Egg collections indicate that the spawning area is located in the lower river in salinities greater than 9.0 ppt. Following hatching, during July and August, the larvae move upstream and congregate in a low salinity nursery area close to the salt-freshwater interface where they remain during winter. As spring approaches the juveniles move toward the spawning area. These two distinct movements, upstream toward the nursery area in fall and downstream toward the spawning area in spring, apparently continue at least through the fourth year. As the fish mature they progressively increase their range of travel away from the nursery ground toward higher salinities. Life history activities were determined by monitoring an abundant 1963 year-class using three sampling techniques; meter nets, shallow and deep water trawls. The importance of various segments of the estuary for completion of life history cycles is emphasized. (Authors)

10962. Tiemeier, O. W., C. W. Deyoe, and C. Suppes. 1967. PRODUCTION AND GROWTH OF CHANNEL CATFISH FRY (Ictalurus punctatus). Trans. Kansas Acad. Sci., 70(2): 164-170.

10963. Tiemeier, Otto W., and C. W. Deyoe (Depts. of Zoology and Grain Science and Industry, Kansas State Univ., Manhattan, Kan.). 1968. A REVIEW OF TECHNIQUES USED TO HATCH AND REAR CHANNEL CATFISH IN KANSAS AND PROPOSED RESTRICTIONS ON NUTRITIONAL REQUIREMENTS OF FINGERLINGS. Trans. Kansas Acad. Sci., 71(4): 491-503.

Problems encountered in incubating channel catfish embryos (Ictalurus punctatus) were solved at the Kansas Forestry, Fish and Game Commission hatchery by several ingenious developments in the 1920's. Spawns were collected from containers placed in spawning ponds and masses of embryos were placed into wire cages set in metal troughs housed in the hatchery building. Over each cage a metal plate was caused to move back and forth to force water through the mass of embryos. The movement of the plates simulated the fanning action of male fish over the embryos and excellent hatching success was obtained. Considerable difficulty was encountered in attempts to feed small fish. Supplemental feeding of dried buttermilk and meat scraps produced only fair growth. Numerous investigations on various phases of channel catfish nutrition were discussed. The authors proposed certain restrictions on nutritional requirements of fingerling channel catfish. (Auth.)

10964. Miller, Robert Victor. 1969. CONSTANCY OF EPIBRANCHIAL ORGANS AND FOURTH EPIBRANCHIAL BONES WITHIN SPECIES GROUPS OF CLUPEID FISHES. Copeia, No. 2, pp. 308-312.

The structure of epibranchial organs and the shape of the fourth epibranchial bones in clupeid fishes reflect phylogenetic relationships on the species group or generic level. Distinctive bone shapes of 18 species in four genera are illustrated. Clupea has lost its epibranchial organs, and the other genera exhibit several kinds of organ structure: Opisthonema has a curved continuous tube, Dorosoma has an entrance canal bending sharply into a terminal blind sac, and Brevoortia has a sac-like chamber. Use of these characteristics may facilitate the allocation of problematical species to the various clupeid genera. (Auth.)

10965. Hubbs, Clark, and Alex E. Peden. 1969. Gambusia georgei SP. NOV. FROM SAN MARCOS, TEXAS. Copeia, No. 2, pp. 357-364.

Three species of Gambusia occur sympatrically in the upper San Marcos River; each species occupies a specific habitat. One has not previously been noted in the literature and is herein described as Gambusia georgei. The limited hybridization with G. affinis does not seem to have reduced the specific integrity of either type. The new species is extremely rare and could be exterminated by minor habitat modifications. Gambusia georgei is a localized endemic inhabiting thermally consistent shallow water over muddy bottom with sparse aquatic vegetation in the San Marcos River. It is differentiated from all other species of Gambusia by having more than five segments of ray 4a incorporated into the elbow of the gonopodium and by having a compound claw on the end of ray 4p. (Authors)

10966. Bryan, Charles F. 1969. VARIATION IN SELECTED MERISTIC CHARACTERS OF SOME BASSES, Micropterus. Copeia, No. 2, pp. 370-373.

Roentgenograms of 678 individuals of the genus Micropterus are examined. Mean numbers of anal rays are generally greater and the mean numbers of vertebrae are less in M. punctulatus from upstream localities compared to downstream stations on the Ohio River. Some M. punctulatus have as few as 30 vertebrae; the previous low recorded for this character in the genus is 31. The subspecies M. s. salmoides and M. s. floridanus may be distinguished on the basis of their respective ratios of abdominal to caudal vertebrae. (Auth.)

10967. Hynes, H. B. N., and Mary J. Coleman (Dept. of Biology, Univ. of Waterloo, Waterloo, Ont., Canada). 1968. A SIMPLE METHOD OF ASSESSING THE ANNUAL PRODUCTION OF STREAM BENTHOS. Limnol. and Oceanogr., 13(4): 569-573.

It is possible to calculate the annual production of stream benthic animals from data obtained from a series of good quantitative samples collected at intervals during the year. The method is explained and its limitations and shortcomings are discussed. This seems at present to be the only simple and direct method of estimating production. (Authors)

10968. Spaulding, Willard M., Jr., and Ronald D. Ogden. 1968. EFFECTS OF SURFACE MINING ON THE FISH AND WILDLIFE RESOURCES OF THE UNITED STATES. Bureau of Sport Fisheries and Wildlife Resource Publication 68. 51 p. Illus.

This report makes available fish and wildlife data obtained in connection with the special study, authorized by Public Law 89-4, relating to surface mining in the United States. Biologists of the Bureau of Sport Fisheries and Wildlife, who participated in the national study, identify about 2 million acres of fish and wildlife habitat damaged by mining: 13,000 miles of streams (135,970 surface acres), 281 natural lakes (103,630 surface acres), 168 reservoirs and impoundments (41,516 surface acres), and 1,687,288 acres of land. Sixty-two percent of this damage is east of the Mississippi. Problems are discussed and recommendations for their solution are presented. (Authors)

10969. Hodgins, H.O., W.E. Ames, and F.M. Utter (Bur. of Commercial Fisheries Biological Lab., Seattle, Wash.). 1969. VARIANTS OF LACTATE DEHYDROGENASE ISOZYMES IN SERA OF SOCKEYE SALMON (Oncorhynchus nerka). J. Fish. Res. Bd. Canada, 26(1): 15-19.

Three phenotypes of lactate dehydrogenase (LDH) isozymes were found in sera of sockeye salmon (Oncorhynchus nerka), presumably representing B'B', B'B, and BB genotypes. No association was obvious between LDH phenotype of sera and sex or total body length. Of 1,006 sera from Asian, Bristol Bay, and Gulf of Alaska stocks, 826 were B'B' and 180 were B'B or BB. Of 591 sera from Washington and British Columbia stocks, 589 were B'B' and 2 were B'B; both of the B-allele phenotypes were found in fish captured at the Skeena River in northern British Columbia. These findings suggested that LDH isozymes should be useful in studies on ocean distribution of sockeye salmon and in characterizing certain Asian and Alaskan sockeye salmon populations. (Authors)

10970. Haines, Terry A., and Robert L. Butler (Penn. Coop. Fish. Unit, Dept. of Biology, Pennsylvania State Univ., University Park, Penn.). 1969. RESPONSES OF YEARLING SMALLMOUTH BASS (Micropterus dolomieui) TO ARTIFICIAL SHELTER IN A STREAM AQUARIUM. J. Fish. Res. Bd. Canada, 26(1): 21-31.

Juvenile smallmouth bass showed a marked response of utilizing opaque plastic coverts in a stream aquarium with two water velocities (12 and 28 cm/sec). The most complex of six opaque coverts at the higher water velocity was occupied a mean time of 7,190 $\pm$ 6 out of 7,200 sec. The presence of a visual reference point was the first feature to attract a fish to a covert for a marked period of time. The addition of an area of darkness increased the use of a covert. Maximum use was obtained with the above features plus an area of quiet water. Clear plastic coverts, which supplied only thigmotactic stimuli or thigmotactic stimuli and an area of quiet water, were rarely used. (Authors)

10971. Northcote, T.G. (Fish and Wildlife Br., Dept. Recreation and Conservation, and Inst. of Fisheries, Univ. of British Columbia, Vancouver, B.C., Canada). 1969. LAKEWARD MIGRATION OF YOUNG RAINBOW TROUT (Salmo gairdneri) IN THE UPPER LARDEAU RIVER, BRITISH COLUMBIA. J. Fish. Res. Bd. Canada, 26(1): 33-45.

Lakeward migration of rainbow trout fry was studied in the upper Lardeau River, where the young emerge from a spawning area immediately below the outlet of Trout Lake utilized by large trout from Kootenay Lake, about 56 km downstream. Most fry move downstream towards Kootenay Lake shortly after emergence; however, some, particularly later in the emergence period, move upstream into Trout Lake. Field observations and experiments suggest that water temperature may be important in inducing different responses to water current in these fish, but may not play such a predominant role or operate at the same levels as proposed earlier for control of young trout migration in the Loon Lake system. (Auth.)

10972. Cherrington, A. D., U. Paim, and O. T. Page (Dept. of Biology, Univ. of New Brunswick, Fredericton, N. B., Canada). 1969. IN VITRO DEGRADATION OF DDT BY INTESTINAL CONTENTS OF ATLANTIC SALMON (Salmo salar). J. Fish. Res. Bd. Canada, 26(1): 47-54.

Fresh mid- and hind-gut contents of young, hatchery-reared Atlantic salmon degraded p, p'-DDT to p, p'-TDE in vitro. Most of the ability to degrade DDT, attributable to intestinal microflora, was eliminated by streptomycin and by heat-sterilization of the gut contents. Since TDE is less toxic than DDT, the activity of intestinal microorganisms may increase the chances of survival of fish that ingest DDT-contaminated prey. (Authors)

10973. Lie, Ulf (Dept. of Oceanography, Univ. of Washington, Seattle, Wash.). 1969. STANDING CROP OF BENTHIC INFAUNA IN PUGET SOUND AND OFF THE COAST OF WASHINGTON. J. Fish. Res. Bd. Canada, 26(1): 55-62.

During the period May 28 to August 1, 1967, benthic infauna was collected at 37 stations in Puget Sound and off the coast of Washington. When large but rare species were excluded from the samples, the variability in standing crop (ash-free dry weight) among replicate samples was less than among means from different stations. The mean standing crop for the offshore stations was 1.92 g/m^2, which is comparable with the standing crop on the shelf in the Gulf of Alaska, but less than half the mean standing crop for the Puget Sound stations; the difference may be explained in part by differences, previously reported, in primary productivity of the water masses. For the offshore stations there was a weak trend of increasing standing crop with depth. The standing crop at the shallow-water offshore stations, in substrates characterized as fine sand, was dominated by crustaceans and small lamellibranchs, whereas at the deeper stations, in sediments with high percentages of silt and clay, polychaetes and echinoderms were the most important contributors. (Auth.)

10974. Mason, J. C. (Dept. of Fisheries and Wildlife, Oregon State Univ., Corvallis, Oreg.). 1969. HYPOXIAL STRESS PRIOR TO EMERGENCE AND COMPETITION AMONG COHO SALMON FRY. J. Fish. Res. Bd. Canada, 26(1): 63-91.

Competition among coho salmon fry in stream aquaria supplying natural drift was found to reflect the history of exposure of eggs and resulting fry to dissolved oxygen concentration prior to emergence. Size disparities induced by differential hypoxial stress were amplified with time, and fry that had been exposed to the most severe hypoxial conditions were most prone to emigrate. Most emigrants placed in an initially vacant, replicate system remained there, grew rapidly, and became as large as, or larger than, nonemigrants. Size of former emigrants reflected enhanced feeding opportunity due to less competition for food and space in the replicate system. Competition was referred more precisely to hypoxial history by using net production. A replicate population fed hatchery food provided a comparison. When exposed to the stream aquaria, this population substantiated the previous findings. Diel cycles of activity and aggression peaked at dawn and dusk, and were related to competition for food and space. The ecological significance of the results is discussed with particular regard to competition for food and space, and the effect of a size-related social order that put smaller individuals at a disadvantage. (Auth.)

10975. Peterson, R. H., and J. M. Anderson (Dept. of Biology, Carleton Univ., Ottawa, Ont., Canada). 1969. INFLUENCE OF TEMPERATURE CHANGE ON SPONTANEOUS LOCOMOTOR ACTIVITY AND OXYGEN CONSUMPTION OF ATLANTIC SALMON, Salmo salar, ACCLIMATED TO TWO TEMPERATURES. J. Fish. Res. Bd. Canada, 26(1): 93-109.

Measurements of the effect of rapid change in temperature on the spontaneous activity and oxygen consumption were made on Atlantic salmon underyearlings acclimated to 6° or 18° C. The new levels of imposed temperature ranged from 6° to 30° C for both acclimations. At similar test temperatures the calculated standard metabolic rate of the fish acclimated to 6° C was higher than that of the fish

acclimated to 18° C, up to about 23° C, where the two curves relating oxygen consumption and temperature intersect. Spontaneous activity could be separated into two phases, a transient phase occurring during the actual period of temperature change, and a stabilized phase. The transient phase was characterized by a peak in activity which was found to be correlated with the rate, rather than the amount, of the temperature change. In general, the peak was higher for fish acclimated to 18° C. The relation between activity in the stabilized phase and test temperature was characterized by a plateau or maximum in the general region of the previously determined selected temperature. Except at the coldest test temperature (6° C), the fish acclimated to 6° C were more active in the stabilized phase than were the fish acclimated to 18° C at similar test temperatures. Complete acclimation for both metabolism and activity, between 6° and 18° C, requires about 2 weeks, regardless of the direction of the temperature change. (Authors)

10976. Smith, Charlie E., and John E. Halver (Western Fish Nutrition Lab., Bur. of Sport Fisheries and Wildlife, Cook, Wash.). 1969. FOLIC ACID ANEMIA IN COHO SALMON. J. Fish. Res. Bd. Canada, 26(1): 111-114.

Juvenile coho salmon (Oncorhynchus kisutch) fed a folic acid-deficient diet and sampled at 6, 9, 12, and 14 weeks developed macrocytic anemia. The anemia, first observed at 6 weeks, was characterized by a significant reduction in red blood cell count as well as macrocytosis and poikilocytosis of erythrocytes. The abnormally shaped erythrocytes observed in peripheral blood smears may be an important aid in the identification of folic acid deficiency in coho salmon. Gross manifestations of the deficiency were extremely pale gills; exophthalmia, often accompanied by ascites fluid; dark coloration; and reduction in growth. Fish recovered after 8 weeks on a diet adequate in folic acid and exhibited a normal blood picture. (Authors)

10977. Wedemeyer, Gary, A. J. Ross, and Lynnwood Smith (Western Fish Disease Lab., Bur. of Sport Fisheries and Wildlife, Sand Point Naval Air Station, Seattle, Wash.). 1969. SOME METABOLIC EFFECTS OF BACTERIAL ENDOTOXINS IN SALMONID FISHES. J. Fish. Res. Bd. Canada, 26(1): 115-122.

Coho salmon (Oncorhynchus kisutch) and rainbow trout (Salmo gairdneri) were highly resistant to endotoxins from both Escherichia coli and Aeromonas salmonicida (a fish pathogen) at 14° and 18° C. This resistance was investigated with liver tryptophan pyrrolase, liver glycogen depletion in vitro, and the arterial blood pressure as indicators. Liver glycogen depletion was accelerated by both endotoxins, but there was no significant cardiovascular response or effect on liver tryptophan pyrrolase activity. Since the cardiovascular effects of histamine were also limited, it was concluded that the metabolic effects of bacterial endotoxins in salmonids are qualitatively different from those of the higher vertebrates. (Authors)

10978. Pienaar, L. V., and J. A. Thomson (Fisheries Research Board of Canada Biological Station, Nanaimo, B. C., Canada). 1969. ALLOMETRIC WEIGHT-LENGTH REGRESSION MODEL. J. Fish. Res. Bd. Canada, 26(1): 123-131.

Two methods of fitting the allometric weight-length relationship are described, one involving the common logarithmic transformation of variables in a multiplicative model and the other assuming an additive nonlinear model and general nonlinear estimation procedures. Differences in the assumptions involved in the two methods are emphasized and the practical significance of the different methods is demonstrated with the aid of a sample problem. A number of procedures are suggested to compensate for possibly unjustified assumptions. (Authors)

10979. Phillips, Robert W., and K. V. Koski (Oregon State Game Comm., Div. of Wildlife Research, Corvallis, Oreg.). 1969. A FRY TRAP METHOD FOR ESTIMATING SALMONID SURVIVAL FROM EGG DEPOSITION TO FRY EMERGENCE. J. Fish. Res. Bd. Canada, 26(1): 133-141.

The method involves a trap of nylon netting placed over an individual redd with the trap's edges buried 15-20 cm in the gravel just outside the periphery of the redd. It has been used successfully on more than 70 coho salmon (Oncorhynchus

kisutch) redds over the past 5 years, with as many as 2,061 fry being captured from a single redd. The trap is relatively stable because it is flexible and conforms to the surface of the streambed, causing debris to float or roll over the surface. It can be used on individual redds; thus, emergent survival for separate parental combinations can be estimated. Field tests showed the efficiency of the trap approached 100%. Installation and presence of the trap had no significant effect on intragravel dissolved oxygen and gravel permeability. Mortality of fry in the traps averaged less than 1.5% when fry were removed at least three times a week. We concluded that the trap provides a more accurate estimate of survival from egg deposition through fry emergence than four other methods. (Authors)

10980. Beck, B., and A. W. Mansfield (Fisheries Research Board of Canada, Arctic Biological Station, St. Anne de Bellevue, Que., Canada). 1969. OBSERVATIONS ON THE GREENLAND SHARK, Somniosus microcephalus, IN NORTHERN BAFFIN ISLAND. J. Fish. Res. Bd. Canada, 26(1): 143-145.

Eighteen immature Greenland sharks (Somniosus microcephalus (Bloch and Schneider) 1801) were captured during the course of a study on the biology of the narwhal, Monodon monoceros. Most had been feeding on offal resulting from the whaling operation and on fish and seal meat discarded at the campsite. Other food consumed included 2 egg cases of the arctic skate, Raja hyperborea, previously unrecorded from this locality. Four narwhals and one white whale were attacked in the nets, the sharks removing large chunks of skin and blubber from the carcasses. (Authors)

10981. Pequegnat, John E., Scott W. Fowler, and Lawrence F. Small (Dept. of Oceanography, Oregon State Univ., Corvallis, Oreg.). 1969. ESTIMATES OF THE ZINC REQUIREMENTS OF MARINE ORGANISMS. J. Fish. Res. Bd. Canada, 26(1): 145-150.

The amount of enzyme-bound zinc is calculated from estimates of total enzyme concentrations and the number of zinc atoms per mole of these enzymes. This estimate is shown to be smaller than measured concentrations in marine organisms, indicating that zinc is accumulated in excess of the organisms' immediate needs. A minimum "potential fertility" for zinc is calculated; the results indicate that zinc is not limiting in the marine environment. (Authors)

10982. Heinle, Donald R. (Dept. of Zoology, Univ. of Maryland, College Park, Md.). 1969. CULTURE OF CALANOID COPEPODS IN SYNTHETIC SEA WATER. J. Fish. Res. Bd. Canada, 26(1): 150-153.

The calanoid copepods Acartia tonsa and Eurytemora affinis were successfully cultured in two commercial synthetic sea salts. Success of a medium was measured by its ability to sustain a population of copepods that was subjected to moderate rates of harvest. (Auth.)

10983. Silliman, R. P. (Bur. of Commercial Fisheries Biological Lab., Seattle, Wash.). 1969. COMPARISON BETWEEN GOMPERTZ AND VON BERTALANFFY CURVES FOR EXPRESSING GROWTH IN WEIGHT OF FISHES. J. Fish. Res. Bd. Canada, 26(1): 161-165.

The two types of curves were fitted to empirical weights-at-age for four commercially important species: sardines, haddock, lake trout, and chum salmon. For the range of observed data, both curves fit the empirical points well, and seem almost indistinguishable on this basis. The upper asymptotic limit of weight, however, was higher for the von Bertalanffy than for the Gompertz, in all four examples. Fitting complexity is similar for both types of curves, but the Gompertz does not require the assumption of cubic length-weight relation implicit in the Beverton-Holt treatment of the von Bertalanffy. (Auth.)

10984. Ball, Robert C., and Niles R. Kevern. 1969. THE RED CEDAR RIVER REPORT II. BIOECOLOGY. Publications of the Museum, Michigan State Univ., 4(4): 107-157.

10985. Muir, B. S. (Fisheries Research Board of Canada, Marine Ecology Lab., Bedford Inst., Dartmouth, N. S., Canada). 1969. GILL DIMENSIONS AS A FUNCTION OF FISH SIZE. J. Fish. Res. Bd. Canada, 26(1): 165-170.

The relationship between total gill area and body weight can be expressed as $Y + aW^b$ where "b" varies from about 0.8 to 0.9 for different species. The area for a 1-g fish ("a") ranges 22-fold for published data on different species. Expressed by the same general equation, the number of secondary lamellae per millimeter of filament ranges 4-fold for different species and decreases with increasing fish weight within each species by a power of about -0.1. (Auth.)

10986. Crossman, E. J., and John M. Casselman (Dept. of Ichthyology, Royal Ontario Museum, Toronto, Ont., Canada). 1969. IDENTIFICATION OF NORTHERN PIKE AND MUSKELLUNGE FROM AXIAL SKELETONS, SCALES, AND EPIPLEURALS. J. Fish. Res. Bd. Canada, 26(1): 175-178.

Grooves and knobs on the vertebrae, ratio of length and width of scales, and ratio of lengths of rami of epipleural bones enabled us to separate northern pike and muskellunge in mutilated specimens, stomach contents, and archaeological material. (Authors)

10987. Allen, K. Radway (Fisheries Research Board of Canada, Biological Station, Nanaimo, B. C., Canada). 1969. AN APPLICATION OF COMPUTERS TO THE ESTIMATION OF EXPLOITED POPULATIONS. J. Fish. Res. Bd. Canada, 26(1): 179-189.

This paper describes a computer programme for the estimation of the size of exploited populations by methods described in Allen (1966, J. Fish. Res. Bd. Canada, 23: 1553-1574). Although these methods were originally developed for use on whale populations, they are applicable to any other populations where suitable data are available. The essential data are the total catch, the catch for a known amount of effort, and the age distribution of the catch, all for a series of years. An estimate of natural mortality rate is also required but population estimates may be obtained for up to 10 values of this parameter in a single computer run. The entire programme incorporates six subroutines, as well as the main controlling programme. One subroutine reads in the catch and effort data, a second reads in the age distribution data for each year and, if necessary, converts it according to a predetermined transformation from age expressed in terms of whale ear-plug laminations to age in years. The third subroutine estimates the rate of recruitment as the proportion of newly recruited animals in the catch for each year, using the method of Allen (1966). The other three subroutines derive population estimates, using the "q," modified DeLury, and actual and expected catch methods (Allen, 1966). As Many sets of data as desired may be processed in a single computer run. (Auth.)

10988. Nunan, Peter J. 1967. PINK SALMON IN LAKE SUPERIOR. Ontario Fish and Wildlife Review, 6(3/4): 9-14.

In the fall of 1959 two pink salmon were taken in Minnesota streams flowing into Lake Superior and since that more have been taken in both Ontario and Minnesota waters tributary to Lake Superior. Some coho and sockeye salmon have recently been taken in Lake Superior by commercial fishermen. The pink salmon may not survive in Lake Superior, but since the accidental stocking of a few in 1956, six generations have hatched and spawned in the tributaries. Many previous attempts to stock Pacific salmon in the Great Lakes were unsuccessful.

10989. Welker, Bill D. 1967. COMPARISON OF CHANNEL CATFISH POPULATIONS IN CHANNELED AND UNCHANNELED SECTIONS OF THE LITTLE SIOUX RIVER, IOWA. Proc. Iowa Acad. Sci., 74: 99-104.

Comparisons are made of channel catfish in channeled and unchanneled sections of the Little Sioux River with regard to abundance, movement, and age and growth. Mean catches per unit effort of channel catfish were higher during May to October bi-weekly periods in the unchanneled section. Movement was predominantly downstream in both areas. In the unchanneled section 23.7% moved upstream, 69.6%

moved downstream, and 6.7% were recaptured at their release site. In the channeled area 25.8% moved upstream, 39.8% moved downstream and 34.4% were recaptured at their release site. Due to the free exchange of catfish between both areas, growth rates were similar in both areas. The largest mean annual increment in both areas (4.42 inches) occurred in the second year. (Auth.)

10990. Zach, Larry V. 1967. FISH DISTRIBUTION IN SKUNK RIVER DRAINAGE ABOVE AMES. Proc. Iowa Acad. Sci., 74: 105-116.

From June 10 to November 17, 1966, 31 species of fish were recorded from the Skunk River above Ames. Length frequencies indicate the seasonal growth of Notropis cornutus, N. lutrensis, Pimephales notatus, and P. promelas. Species associated with headwater, riffle, pool and main channel are listed. (Auth.)

10991. Job, S. V. (Dept. of Zoology, Madurai Univ., Madurai-2, India). 1969. THE RESPIRATORY METABOLISM OF Tilapia mossambica (TELEOSTEI). Marine Biol., 2(2): 121-126.

In a series of experiments 174, 120 and 139 individuals of the teleost Tilapia mossambica (Peters), were acclimated to 30° C and to salinities of 0.4, 12.5 and 30.5 ‰, respectively. The effect of temperature and salinity upon oxygen consumption was studied by abruptly transferring fish of different wet weights to temperatures from 15° to 40° C at an average initial pO_2 of 250 mm Hg. At each salinity, the proportionate response to temperature is size-independent. The metabolic rate increases as a function of temperature at 15° and 30° C but not at 40° C. Oxygen consumption is, however, salinity dependent; maximum rates are obtained at 12.5 ‰ S. This salinity is isotonic in the 80 g fish and, to a lesser extent, in the 5 g fish. Reduction in osmotic load is suggested as the probable cause for a greater scope for activity and greater rate of oxygen consumption in 12.5 ‰ salinity. (Auth.)

10992. Ishac, Mounir, and Alexander M. Dollar (College of Fisheries, Univ. of Washington, Seattle, Wash.). 1968. STUDIES ON MANGANESE UPTAKE IN Tilapia mossambica AND Salmo gairdnerii. I. GROWTH AND SURVIVAL OF Tilapia mossambica IN RESPONSE TO MANGANESE. Hydrobiologia, 31(3/4): 572-584.

Tilapia mossambica fingerlings, 5 weeks of age, were reared in simulated fresh water medium which was either free of manganese or supplied with manganese at a concentration of 2.5 µg/l. They were fed synthetic diets which were either deficient (2.8 mg Mn/kg dry diet) or supplied with manganese (35.5 mg Mn/kg dry diet). The feeding tests were carried for 10 weeks. Best growth was obtained when the element was supplied in both food and water. When manganese was absent or was supplied only in water or food, the following symptoms were noted: (1) poor growth, (2) reduced food consumption, (3) loss of equilibrium, and (4) increased mortality. From the results, the daily requirement for manganese by Tilapia for growth and development was calculated to be 1.7 mg/kg live fish. (Authors)

10993. Burnet, A. M. R. (Fisheries Lab., Marine Dept., Christchurch, New Zealand). 1969. AN EXAMINATION OF THE USE OF SCALES AND FIN RAYS FOR AGE DETERMINATION OF BROWN TROUT (Salmo trutta L.). N. Z. Jl. mar. Freshwat. Res., 3(1): 147-151.

Scales and fin rays from brown trout (Salmo trutta L.) of known age were examined. Only 6 out of 29 scales were read correctly by 2 operators. The commonest fault was to read an extra year into the first year's growth. Fin ray sections proved much easier to read than the scales. The author correctly read all of a sample of 22 fin ray sections. (Auth.)

10994. Strasburg, Donald W. (Bur. of Commercial Fisheries Biological Lab., Honolulu, Hawaii). 1969. BILLFISHES OF THE CENTRAL PACIFIC OCEAN. U. S. Fish and Wildlife Service Circular 311. 11 p.

The billfishes are found in all warm seas. In the central Pacific, the striped and blue marlins are common or abundant; the black marlin is uncommon; the Pacific sailfish, broadbill swordfish, and shortbill spearfish are rarely caught.

These fishes feed broadly on fish, squid, crustaceans, and other foods available on the high seas. In commercial catches of blue marlin in Hawaii, males and females appear in about equal numbers; but on a short-term basis, one sex can predominate. During the Hawaiian International Billfish Tournaments, which are held during the summer, more males are usually caught than females. In the commercial catch, the heaviest blue marlin (300-500 pounds) were taken in the spring, the lightest in the summer. Striped marlin show two peaks of abundance through part of the year. Blue marlin are most abundant in the summer. Striped marlin tend to occur in large numbers just when the blue marlin are least abundant. The longest migration recorded in the central Pacific was 3,000 miles, by a striped marlin that was tagged off Baja California, Mexico, later caught near the Hawaiian Islands. (Auth.)

10995. Gatt, Shimon (Scripps Institution of Oceanography, Univ. of California San Diego, La Jolla, Calif.). 1969. THERMAL LABILITY OF BETA GALACTOSIDASE FROM PINK SALMON LIVER. Science, 164(3886): 1422-1423.

The effect of heat on the stability of a protein isolated from a coldwater fish was tested by following the decrease in enzymatic activity of beta galactosidase, purified from livers of Pacific pink salmon. The thermal stability is pH-dependent; it is highest at pH 4 and lowest at neutral pH, where only 30% of the activity remains after 10 minutes at 40° C. Comparative experiments demonstrate greater thermal stability of beta galactosidase from rat liver. (Auth.)

10996. Bureau of Sport Fisheries and Wildlife. 1968. NATIONAL SURVEY OF NEEDS FOR HATCHERY FISH. STATE BY STATE SUMMARIES. Bureau of Sport Fisheries and Wildlife Resource Publication 63 (Part II). 200 p.

The summaries for the 50 States and the District of Columbia are in alphabetical order. Each State summary covers four pages; the fourth page is a map showing the locations of hatcheries in the State.

10997. Borgeson, David P. 1968. TROUT FOR OUR TIMES. Michigan Conservation, 37(3): 11-15.

A resumé of the present and contemplated trout and salmon management plans of the State of Michigan. Only where predators or peculiar food conditions make it necessary are legal sized trout stocked. Small trout are stocked only when streams do not provide enough wild trout and these small trout are to be raised from the eggs of selected wild trout. The size limit is being considered and it is probable that different limits may result for some waters and certain species. Some additional stream improvement will be done and existing structures maintained. Watershed protection, streambank erosion control, fish passage facilities and dam removal will be given attention. The Atlantic salmon is being considered for one or two selected streams and this program will probably be initiated soon. Perhaps summer steelheads can be introduced when certain hatchery improvements have been made. Efforts will be concentrated first on the protection and enhancement of wild trout populations, but where necessary, high quality trout will be stocked.

10998. Stroud, Richard H., and Robert G. Martin (Sport Fishing Inst., 719 - 13th St., N.W., Washington, D.C.). 1968. FISH CONSERVATION HIGHLIGHTS 1963-1967. Sport Fishing Institute, 719 - 13th St., N.W., Washington, D.C. 147 p.

A review of current trends and accomplishments of state and federal agencies in research and management of the sport fishery resources in the United States and Canada.

10999. Avault, James W., Jr. 1968. RID TRASH FISH FROM CATFISH PONDS. Louisiana Conservation, 20(7/8): 8-9.

The toxicant antimycin under the trade name Fintrol can effectively eliminate trash fish from ponds managed to produce catfish. Use of 3 ppb of antimycin costs about $4.50 per acre foot. It eliminates such fish as the sunfishes, shiners, minnows, suckers, carp, buffalo and shad. Catfish, bowfin and gar are more resistant. It took about 20 times as much antimycin to kill channel catfish as it did to kill green sunfish.

11000. Fulton, Leonard A. (Bur. of Commercial Fisheries Biological Lab., Seattle, Wash.). 1968. SPAWNING AREAS AND ABUNDANCE OF CHINOOK SALMON (Oncorhynchus tshawytscha) IN THE COLUMBIA RIVER BASIN--PAST AND PRESENT. U. S. Fish and Wildlife Service Special Scientific Report—Fisheries No. 571. 25 p. Map.

Chinook salmon, the most abundant species of salmon in the Columbia Basin, formerly spawned in nearly all tributaries of the Columbia River and in many areas of the main river. Over the past 60 years, the construction of dams has inundated, impeded, or blocked access to spawning areas. Despite these heavy losses, large areas of spawning grounds in the middle and lower portions of the drainage are still available to chinook salmon. Stream improvements by State and Federal fishery agencies have rehabilitated some areas and have brought others into production for the first time. Important spawning areas are listed and charted in this report according to their past use (before 1965) and present use (1966). Estimates of recent spawning populations in major tributaries and in segments of the main stem are also given. Former and present levels of abundance are listed according to three major runs--spring, summer, and fall. (Auth.)

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